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	Takehiro Nakamura et al.)
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VERIFICATION OF TRANSLATION

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Dear Sir:

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declares:

- (1) that he knows well both the Japanese and English languages;
- (2) that he has carefully reviewed and compared both the Japanese language patent application, (JP) 9/116192, filed on April 17, 1997, and the attached English language translation;

- (3) that the attached English translation is a true and correct translation of the claims, specification, and drawings of the above-identified international application to the best of his knowledge and belief; and
- (4) that all statements made of his own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated this 10th day of March, 2010.

Respectfully submitted,



Hitoshi Yashiro

Case Number: DCMH090007

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BASE STATION APPARATUS IN MOBILE COMMUNICATION SYSTEM

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[Document Name] Specification

[Title of the Invention] BASE STATION APPARATUS IN
MOBILE COMMUNICATION SYSTEM

[Scope of Claim for a Patent]

5 [Claim 1]

A base station apparatus in a mobile communication system characterized by comprising:

a transmission and reception amplifying section that amplifies a CDMA signal transmitted to or received from
10 a mobile station;

a radio section connected to said transmission and reception amplifying section to subject a baseband-spread transmitted signal to a D/A conversion and then to an orthogonal modulation and to subject a received signal to
15 a quasi-synchronous detection and then to an A/D convention;

a baseband signal processing section connected to said radio section to execute baseband signal processing on the transmitted signal and the received signal;

20 a transmission path interface connected to said baseband signal processing section to interface an external channel; and

a base station control section to control radio channel management, setting and releasing of radio
25 channels and so on.

[Claim 2]

The base station apparatus as claimed in claim 1,

characterized in that communication with said external channel is carried out using an ATM cell.

[Claim 3]

5 The base station apparatus as claimed in claim 1 or 2, characterized in that communication with said mobile station using the CDMA signal is carried out by mapping a plurality of logical channels onto a plurality of physical channels.

[Claim 4]

10 The base station apparatus as claimed in any one of claims 1-3, characterized in that the CDMA signal used for communication with said mobile station is spread using two types of spreading sequence codes including a short and long spreading sequence codes.

15 [Detailed Description of the Invention]

[Technical Field to which the Invention Pertains]

The present invention relates to a base station apparatus in a mobile communication system, and more particularly to a base station apparatus capable of
20 communicating with mobile stations through high speed digital communications using CDMA.

[Background Art]

Recently, base stations in mobile communication systems have become increasingly faster owing to the
25 development of novel communication methods such as CDMA, which become possible with recent advances in digital communications techniques. In addition, fixed stations

are also digitized, and come to use new switching networks such as ATM networks.

[Problems to be solved by the Invention]

An object of the present invention is to provide a
5 novel, high speed, digital base station best suited to achieving communications with mobile stations by CDMA, and with a control office by ATM.

[Means for Solving the Problems]

To achieve this object, there is provided a base
10 station apparatus in a mobile communication system characterized by comprising a transmission and reception amplifying section that amplifies a CDMA signal transmitted to or received from a mobile station, a radio
15 amplifying section to subject a baseband-spread transmitted signal to a D/A conversion and then to an orthogonal modulation and to subject a received signal to a quasi-synchronous detection and then to an A/D convention, a baseband signal processing section connected to the radio
20 section to execute baseband signal processing on the transmitted signal and the received signal, a transmission path interface connected to the baseband signal processing section to interface an external circuit, and a base station control section to control radio channel
25 management, setting and releasing of radio channels and so on.

Further, communication with the external channel is

carried out using an ATM cell. Communication with the mobile station using the CDMA signal is carried out by mapping a plurality of logical channels onto a plurality of physical channels. The CDMA signal is spread using two
5 types of spreading sequence codes including a short and long spreading sequence codes.

[Embodiments of the Invention]

1. Outline of a system

1.1. Name

10 W-CDMA radio station apparatus (BTS)

1.2. Explanation of abbreviations.

Abbreviations used in the present application are shown in Table 1.

15

[TABLE 1]

List of abbreviations

No.	Abbreviations	Terms
1	BTS	base transceiver station
2	AMP	transmitting/receiving amplifier
3	MDE	base station modulator/demodulator
4	MS	radio mobile station
5	ANT	Antenna
6	HW	wire transmission path
7	MCC-SIM	mobile control/switching simulation center
8	HW-INT	wire transmission path interface
9	TRX	radio stage
10	BTS-CNT	base transceiver station controller
11	BB	base-band signal processor
12	MT	maintenance tool

1.3. Requirements

5 The present apparatus does not only meet the requirements shown below but is also configured to sufficiently endure vibration during transportation or the like, fully taking operability, maintainability,

reliability, and the like into account.

The present specification is not conclusive and its details may be changed in accordance with the contents of technical meetings, the national or ARIB/TTC's technical conditions, or the like. The conditions other than those described in the present specification which are regulated by the Japanese laws (the Radio Law or the like) obey these laws.

2. Structure

2.1. Functional configuration

The base station apparatus has a configuration as shown in Fig. 1. Shaded portions in the figure correspond to a functional configuration of the BTS. The following contents are intended to show the functional structure and not to restrict a hardware configuration.

2.2. Outline of functions

Table 2 shows an outline of functions of various blocks.

[TABLE 2]

Outline of functions of blocks of BTS

1.	Transmitting/receiving amplifier (AMP)	Being provided with a transmitting amplifier for amplifying a transmitted RF signal, and a low noise
----	--	--

		amplifier for amplifying a received RF signal, duplexing the RF transmitted signal and RF received signal, and connecting them to the ANT.
2.	Radio stage (TRX)	D/A converting a transmitted signal that has been subject to baseband spreading, and converting it to an RF signal by quadrature modulation, and carrying out quasi-coherent detection of a received signal fed from a receiving amplifier, A/D converting it, and transferring it to a baseband block.
3.	Baseband signal processor (BB)	Carrying out baseband processings such as error correcting encoding, framing, data modulation and spreading of transmitted data, and desreading of a received signal, chip synchronization, error correcting decoding, data demultiplexing, maximal ratio combining during inter-sector diversity

		handover, and the like.
4.	Radio base station controller (BTS-CNT)	Exchanging a control signal with MCC-SIM to carry out management of radio channels, and establishment or release of radio channels.
5.	Wire transmission path interface (HW-INT)	Having an ATM processing function, and AAL type 2 and AAL type 5 functions in an inter-office transmission path interface. Providing an SSCOP function to a control signal between MCC-SIM and BS. Generating an operation clock of a BTS from a transmission path.
6.	Maintenance tool (MT)	Having a function of specifying parameters of devices, and a function of collecting data.

2.3. Shape

A BTS has the structure of Table 3.

5 [TABLE 3]

Shape of BTS

Specification	
Height	Less than or equal to 1800 mm
Width	Less than or equal to 800 mm
Depth	Less than or equal to 600 mm

3. Operation conditions

3.1. Electrical characteristics

- 5 * Electrical characteristics are met at an ambient temperature of +5 to 40 °C, a normal humidity of 65±20%, and a rated power voltage of DC-48V±5V.
- * A circuit can be inserted and removed by a closing and resetting operations without the need to stop the power
10 supply to the circuit. Variations in power supply do not affect the system.

3.2. Mechanical characteristics

- * For the parts specified herein, screws do not come loose
15 or the parts do not slip off in spite of vibration during transportation or the like or normal handling operations.

3.3. Startup process

- The base station automatically resets itself when power
20 is turned on.
- When resetting a CPU, the following processing is carried out in accordance with programs in a ROM.
- (1) Internal checking of the CPU.

(2) Start up of APs.

3.4. Measures for jamming

Specifications for jamming waves generated by the
5 present apparatus are described in the M Specification
D0000002. However, the present apparatus is placed in a
center and thus obeys the Radio Law.

3.5. Related regulations

10 Regulations for operation of self-imposed restraint
measures for jamming waves generated by information
processing apparatuses and electronic office equipment
(revised on November 25, 1993; of Self-imposed Restraint
on Jamming in Information Processing Apparatuses and the
15 like) (conforming to CISPR Publ.22).

3.6. Reliability

A target MTBF value for the present apparatus is at
least 15,000 hours. Sufficient considerations are given
20 to make the unitary apparatus reliable.

4. Interface conditions

4.1. Radio interface

4.1.1. Major specifics

25 Table 4 shows major specifics of the radio interface.

[TABLE 4]

Major specifics of radio interface

Item	Specifics
Radio access scheme	DS-CDMA FDD
Frequency	2 GHz band
Carrier frequency spacing	5 MHz (expandable to 1.25/10/20 MHz)
Chip rate	4.096 Mcps (expandable to 1.024/8.192/16.384 Mcps)
Number of switched carriers	2 (select two out of four carries)
Modulation/demodulation scheme	Data: QPSK, pilot symbol coherent detection, and RAKE. Spread: QPSK.
Encoding/decoding scheme	Internal codes: Convolutional encoding (R=1/3 or 1/2, K=9) and Viterbi soft decision decoding. External codes: Reed-Solomon codes (for data transmission)
Symbol rate	16-1024 ksps
Information transmission rate	Variable up to maximum 384 kbps
Transmission power control	SIR based close loop and open loop

Diversity	RAKE + Antenna
Inter-base station sync	Asynchronous

4.1.2. Radio channel structure

4.1.2.1. Logical channel structure

5 Structures of logical channels are illustrated in Fig.
2.

4.1.2.1.1. Broadcast control channels (BCCH1 and BCCH2)

Broadcast control channels (BCCHs) are one-way
10 channels for broadcasting information on the control of
each cell or sector from a base station to mobile stations.
The broadcast control channel transmits time varying
information such as SFNs (System Frame Numbers) and reverse
interference power values.

15

4.1.2.1.2. Paging channel (PCH)

A paging channel (PCH) is a one-way channel for
transmitting the same information from the base station
to mobile stations all at once over a large area. This
20 channel is used for paging.

4.1.2.1.3. Forward access channel-long (FACH-L)

A forward access channel-long is a one-way channel

for transmitting control information or user packet data from the base station to mobile stations. This channel is used only when a network knows the location cell of a mobile station. It is employed to transmit a considerably
5 large amount of information.

4.1.2.1.4. Forward access channel-short (FACH-S)

A forward access channel-short is a one-way channel for transmitting control information or user packet data
10 from the base station to mobile stations. This channel is used only when a network knows the location cell of a mobile station. It is employed to transmit a considerably small amount of information.

15 4.1.2.1.5. Random access channel-long (RACH-L)

A random access channel-long is a one-way channel for transmitting control information or user packet data from mobile stations to the base station. This channel is used only when a mobile station knows its location cell. It
20 is employed to transmit a considerably large amount of information.

4.1.2.1.6. Random access channel-short (RACH-S)

A random access channel-long is a one-way channel for transmitting control information or user packet data from
25 mobile stations to the base station. This channel is used only when a mobile station knows its location cell. It

is employed to transmit a considerably large amount of information.

4.1.2.1.7. Stand alone dedicated control channel (SDCCH)

5 A stand alone dedicated control channel is a point-to-point two-way channel that transmits control information. The stand alone dedicated control channel occupies one physical channel.

10 4.1.2.1.8. Associated control channel (ACCH)

 An associated control channel is a point-to-point two-way channel that transmits control information. This channel is a control channel that is associated with a DTCH.

15 4.1.2.1.9. Dedicated traffic channel (DTCH)

 A dedicated traffic channel is a point-to-point two-way channel that transmits user information.

4.1.2.1.10. User packet channel

20 A user packet channel is a point-to-point two-way channel that transmits user packet data.

4.1.2.2. Structures of physical channels

 Fig. 3 illustrates the structure of a physical
25 channel. Table 5 illustrates the characteristics of individual physical channels.

[TABLE 5]

Characteristics of physical channels

	Perch channels	Common control physical channel.	Dedicated physical channel
Symbol rate:	16ksps	Reverse direction: 16/64 kbps Forward direction: 64 kbps	32/64/128/256 /512/1024 kbps
Transmission power control	Transmission power control is not applied. Usually, there are a first perch channel through which transmission is always carried out, and a second perch channel through which only parts of symbols are	*Only radio frames containing transmitted information are sent. No symbols including pilot symbols are sent of radio frames without containing transmitted information. (PD sections of PCH are always sent). *High speed closed loop transmission power control is not carried out.	High speed closed loop transmission power control can be carried out.

	transmitted.	Symbol rate:	
Transmis sion power control bit	Not included	Not included	Included

4.1.2.2.1. Perch channel

A perch channel is a physical channel whose reception level is measured for selecting a cell of a mobile station.

5 Further, this is a physical channel which is initially captured when the mobile station is turned on. The perch channel includes a first perch channel and a second perch channel: The former is spread by a short code uniquely assigned to the system for accelerating cell selection when
10 the mobile station is turned on; whereas the latter is spread by a short code corresponding to a forward long code, and transmits only a part of symbols. The perch channel is a one-way physical channel from the base station to mobile stations.

15 Short codes used by the second perch channel differ from the short code system employed by the other physical channels.

4.1.2.2.2. Common control physical channel

20 The common control physical channel is used in common

by multiple mobile stations located in the same sector. The reverse common control physical channel is a random access channel.

5 4.1.2.2.3. Dedicated physical channel

Dedicated physical channels are each established between a mobile station and the base station in a point-to-point fashion.

10 4.1.2.3 Signal formats for the physical channels.

All the physical channels assume a three layer structure of a super frame, radio frames, and time slots. The structure of the radio frames and time slots vary depending on the type of the physical channels and a symbol
15 rate. Fig. 4 illustrates the signal formats for channels other than the reverse common control physical channels. The numbers in the figure denote the numbers of the symbols.

4.1.2.3.1. Super frame.

20 The super frame consists of 64 radio frames, and is determined on the basis of SFN which will be described below.

The initial radio frame of the super frame: $\text{SFN mod } 64=0$

25 The final radio frame of the super frame: $\text{SFN mod } 64=0$

4.1.2.3.2. Pilot symbols and SW.

- * Pilot symbol patterns are shown in Table 6. Halftone portions of the figure represent SWs. The symbol pattern of the pilot symbols other than the sync words (SW) is "11".
- * In Table 6, each bit is transmitted in the order of "I" and "Q" from the left-hand side to the right-hand side.
- * In the forward common control physical, a radio frame length can be transmitted in a burst mode. In the burst mode transmission, pilot symbols are added to the final portion of the bursts. The number of symbols and the symbol pattern to be added are as shown in the slot #1 pattern in Table 6.
- * In the reverse common control physical channels, one radio frame forms one burst. Thus, the pilot symbols are added at the final position of the radio frame. The number of symbols and the symbol pattern to be added are as shown in the slot #1 pattern in Table 6.

[TABLE 6]

Pilot symbol patterns

	Pilot symbol patterns															
	256, 512, 1024 kbps dedicated physical channel								16 kbps common control physical channel				Others			
Pilot symbol number	0	1	2	3	4	5	6	7	0	1	2	3	0	1	2	3
slot# 1	11	11	11	11	11	11	11	10	11	11	11	11	11	11	11	11
2	11	10	11	10	11	10	11	01	11	10	11	01	11	11	11	01
3	11	10	11	01	11	11	11	01	11	10	11	10	11	01	11	01
4	11	11	11	01	11	00	11	10	11	01	11	00	11	10	11	01
5	11	11	11	00	11	01	11	10	11	00	11	10	11	10	11	11
6	11	11	11	11	11	01	11	10	11	10	11	11	11	10	11	11
7	11	10	11	11	11	01	11	10	11	10	11	11	11	01	11	00
8	11	01	11	00	11	10	11	00	11	00	11	00	11	10	11	01
9	11	11	11	10	11	00	11	01	—				11	11	11	00
10	11	01	11	11	11	11	11	00					11	01	11	01
11	11	10	11	10	11	11	11	10					11	11	11	10
12	11	01	11	10	11	10	11	00					11	01	11	01
13	11	10	11	01	11	11	11	10					11	00	11	01
14	11	00	11	10	11	10	11	00					11	10	11	00
15	11	01	11	10	11	00	11	00					11	01	11	00
16	11	10	11	00	11	00	11	00					11	00	11	00

4.1.2.3.3. TPC symbol.

The relationships between TPC symbol patterns and
5 transmission power control amounts are shown in Table 7.

[TABLE 7]

TPC symbol patterns

TPC symbol	transmission power control amount
11	+1.0 dB
00	-1.0 dB

4.1.2.3.4. Long code mask symbol.

* A long code mask symbol is spread only by a short code
5 without using any long codes.

* Although symbols of the perch channels other than the long code mask symbol use the short codes in layered orthogonal code sequences as shown in Fig. 18, the long code mask symbol is spread using the short code selected
10 from the orthogonal Gold sequences with a code length of 256. The details will be described in 4.1.4.1.3.

* One long code mask symbol is contained in every slot in the first and second perch channels, and its symbol pattern is "11".

15 * The perch channels use two spreading codes to transmit their long code mask symbols individually. In particular, the second perch channel transmits only the long code mask symbol without transmitting any other symbols.

20 4.1.2.4. Mapping of the logical channels onto the physical channels.

Fig. 6 illustrates the relationships between the physical channels and the logical channels that are mapped

onto the physical channels.

4.1.2.4.1. Perch channels.

Fig. 7 illustrates an example of mapping of a logical
5 channel onto a perch channel.

- * Only BCCH1 and BCCH2 are mapped.
- * Onto the initial position of the super frame, BCCH1 is mapped without exception.
- * For the mapping other than the mapping of the BCCH1 into
10 the initial position of the super frame, either BCCH1 or BCCH2 is mapped in accordance with structure information designated by a macro.
- * On the BCCH1 and BCCH2, $2 \times N$ consecutive radio frames are consecutively transmitted so that two radio frames
15 constitute one radio unit, and transmit one layer 3 message. The layer 3 message transmitted through the BCCH1 and BCCH2 do not overlay two or more super frames.
- * The BCCH1 and BCCH2 each transmit, in each radio unit, the following information which is generated by the BTS.
- 20 * SFN (System Frame Number).
- * Reverse interfering power amount.

The transmitted contents of the SFN and reverse
interfering power amount vary over time. The reverse
interfering power amount is the latest result measured by
25 the BTS.

4.1.2.4.2. Common control physical channel.

* Only PCH and FACHs are mapped into the forward common control physical channel. RACHs are mapped into the reverse common control physical channel.

* Either FACHs or PCHs are mapped into a single forward
5 common control physical channel.

* The macro determines, for each common control physical channel established, whether the logical channel to be mapped into the single forward common control physical channel is PCH or FACH

10 * One forward common control physical channel into which the FACHs are mapped is paired with one reverse common control physical channel. The pair is designated by a pair of spreading codes. The pair is designated in terms of the physical channel and the sizes (S/L) of the FACH and
15 RACH are not defined. A FACH and RACH received and transmitted by a mobile station are present on the paired forward common control physical channel and reverse common control physical channel. In addition, in an Ack transmission process by the BTS in response to the received
20 RACH, which will be described later, the Ack is transmitted through the FACH-S on the forward common control physical channel which is paired with the reverse common control physical channel through which the received RACH is transmitted.

25

4.1.2.4.2.1. A method of mapping PCHs into the common control physical channel

Fig. 8 illustrates a method of mapping the PCHs.

* The PCHs are each divided into a plurality of groups within one super frame, and each group transmits the layer
5 3 information.

* The number of groups per common control physical channel is 256.

* Each group of PCHs contains information for four time slots, and consists of six information portions: two
10 portions are for incoming call presence and absence indicators (PD portions), and the remaining four portions are for called user identification number portions (I portions).

* The PD portions are transmitted prior to the I portions
15 in each group.

* For all the groups, the six information portions are arranged over 24 time slots in a predetermined pattern. The pattern over the 24 time slots is shifted every four slots so as to dispose the plurality of groups on the single
20 common control physical channel.

* The first PCH is disposed such that the initial symbols of the PD portion of the first PCH become the initial symbols of the super frame. The sections of PCHs in each group are disposed in the PCH radio frames such that they
25 are shifted every four time slots in the order of the second group, third group, etc.

* The final one of the groups overlays the two super frames.

4.1.2.4.2.2. Method of mapping the FACH onto the common control physical channel.

Fig. 9 shows a mapping example of the FACH.

5 * Any FACH radio frame on a common control physical channel can be used as either a logical channel FACH-L or FACH-S. The logical channel that receives a transmission request first is transmitted by the FACH radio frame.

* If the length of information to be transmitted by the
10 FACH is larger than a predetermined value, the FACH-L is used, and otherwise the FACH-S is used. This determination is made by hardware, and the predetermined value is designated by the macro.

* For the FACH-S, four FACH-S's are time multiplexed into
15 one FACH radio frame to be transmitted.

* Each of the four FACH-S's consists of four time slots and is disposed in one radio frame at intervals of four time slots, with one slot shifted for each FACH-S. Thus, the time slots assigned to the four FACH-S's are as
20 follows.

First FACH-S: First, fifth, ninth, and 13th time slots.

Second FACH-S: Second, sixth, 10th, and 14th time slots.

25 Third FACH-S: Third, seventh, 11th, and 15th time slots.

Four FACH-S: Fourth, eighth, 12th, and 16th time

slots.

* If the first logical channel that receives a transmission request is a FACH-S, other FACH-S'es that are stored in a buffer at that time can be multiplexed into the same FACH radio frame and transmitted for up to four hours. In this case, even if a FACH-L has been stored by that time, FACH-S'es that receive a transmission request later than that FACH-L can be multiplexed and transmitted.

* A mobile station can simultaneously receive all of the FACH-S'es and FACH-L on each common control physical channel. It is sufficient for a mobile station to receive one common control physical channel even if a base station transmits a plurality of common control physical channels that transmit FACHs. Which one of the plurality of common control physical channels is to be received by the mobile station is determined between the mobile station and the BTS.

* The FACH-S has two modes of transmission format. One is a format (layer 3 transmission mode) for transmitting information of layer 3 and higher order which is designated by an AP via the macro. The other is a format (ACK mode) for transmitting an ACK in response to reception of a RACH.

* An ACK mode FACH-S can contain ACKs for up to seven mobile stations at maximum.

* An ACK mode FACH-S is always transmitted as the first FACH-S.

* An ACK mode FACH-S is transmitted first, even if the

transmission request is received after other FACH's.

* If an information volume of a higher rank information form (CPS) that is transmitted by FACH radio units amounts to a plurality of FACH radio units, a continuous

5 transmission is guaranteed. No other CPS is allowed to intrude into the transmission. Even the ACK mode FACH-S, which is given top priority as described above, is not allowed to intrude into the transmission.

* When one CPS is transmitted with a plurality of FACH radio
10 units, either FACH-L's or FACH-S'es are used and they are not mixed together.

* When one CPS is transmitted continuously with a plurality of FACH-S radio units, the (n+1)-th FACH-S radio unit follows the n-th FACH-S radio unit, except that it is the
15 first FACH-S radio unit that follows the fourth FACH-S radio unit.

4.1.2.4.2.3. A method of mapping a RACH onto a common control physical channel.

20 * A RACH-S is mapped onto a 16 kbps reverse common control physical channel. A RACH-L is mapped onto a 64 kbps reverse common control physical channel. Both the RACH-S and RACH-L consist of one radio frame of 10 ms long. When they are transmitted through wireless sections, four pilot
25 symbols are added to the final position of the radio frame.

* When transmitting the RACH, a mobile station uses the RACH-L or RACH-S freely in accordance with a transmission

information volume.

* Receiving the RACH-L or RACH-S correctly, a base station transmits Ack to the mobile station through a FACH. The RACH and its associated FACH that transmits the Ack are
5 designated by using the macro to assign the same RL-ID to both the channels.

* The frame timing for transmitting the RACH from the mobile station is delayed by a predetermined offset from a frame timing for the common control physical channel onto which
10 the FACH for transmitting the Ack is mapped. The offset can take 16 values. The mobile station can randomly select one timing from the multiple offsets to send the RACH.

* The base station must have the function of receiving the RACH-L and RACH-S using any of the offset timings.

15

4.1.2.4.3. Dedicated physical channel.

* The SDCCH and UPCH each occupy one dedicated physical channel.

* For 32 to 256 ksps dedicated physical channels, a DTCH
20 and an ACCH are time multiplexed to share the same dedicated physical channel.

* For 512 ksps and 1024 ksps dedicated physical channels, only a DTCH occupies the dedicated physical channel, whereas ACCH is not multiplexed.

25 * The time multiplexing of the DTCH and ACCH is carried out for each time slot by dividing logical channel symbols in the time slot. The ratio of the division varies

depending on the symbol rate of the dedicated physical channel. Fig. 10 illustrates a method of mapping the DTCH and ACCH onto the dedicated physical channel.

* The number of radio frames constituting a radio unit of the ACCH varies depending on the symbol rate of a dedicated physical channel. The radio unit of the ACCH is allocated in synchronism with a super frame such that it is divided in accordance with the number of the time slots and that the subunits obtained are allocated to the respective time slots in one or more radio frames. Fig. 11 illustrates a method of mapping the ACCH onto a super frame of the dedicated physical channel for each symbol rate.

* In multicode transmission, the ACCH radio unit does not overlay two or more physical channels, but is transmitted using a particular one code (physical channel). The particular one code is predetermined.

4.1.2.5. Logical channel coding.

Figs. 67 to 87 illustrate a process of coding logical channels.

4.1.2.5.1. Error detecting code (CRC).

An error detecting code (CRC) is added to each CPSPDU, each internal encoding unit, or each selection combining unit.

4.1.2.5.1.1. Generator polynomials.

(1) 16-bit CRC.

* Application: CPSPDU of all the logical channels except for the DTCH and PCH; internal encoding unit of UPGCHs at all the symbol rates; selection combining unit of the 32 kbps DTCH; and an internal encoding unit of the SDCCH, FACH-S/L or RACH-S/L.

* Generator polynomials: $GCRC16(X) = X^{16} + X^{12} + X^5 + 1$

(2) 14-bit CRC

* Application: ACCHs at all the symbol rates.

* Generator polynomial: $GCRC14(X) = X^{14} + X^{13} + X^5 + X^3 + X^2 + 1$

(3) 13-bit CRC

* Application: Selection combining units of 64/128/256 kbps DTCHs.

* Generator polynomial: $GCRC13(X) = X^{13} + X^{12} + X^7 + X^6 + X^5 + X^4 + X^2 + 1$

(4) 8-bit CRC

Application: CPSPDU of PCH.

Generator polynomial: $GCRC8(X) = X^8 + X^7 + X^2 + 1$

4.1.2.5.1.2. CRC calculation application range

* CRC for each CPSPDU: Entire CPSPDU.

* CRC for each ACCH/DTCH selection combining unit: Entire unit except for tail bits.

* CRC for each SDCCH/FACH/RACH/UPCH internal encoding unit: Entire unit except for tail bits.

* Figs. 67 to 87 illustrate the application range of CRC calculations and CRC bits in shaded portions.

5

4.1.2.5.1.3. Uses of CRC check results.

* CRC for each CPSPDU: Determining whether or not to carry out retransmission according to a retransmission protocol for a higher layer (SSCOP, layer 3 retransmission) CRC for each ACCH/DTCH selection combining unit:

10

(i) outer-loop transmission power control; (ii) selection combining reliability information

* CRC for each UPCH internal encoding unit: outer-loop transmission power control.

15

CRC for each RACH internal encoding unit: layer 1 retransmission.

CRC for each SDDH internal encoding unit: (i) outer-loop transmission power control; (ii) making a decision on the necessity for wire transmission.

20

4.1.2.5.1.4. Initialization of CRC

* The initial value of a CRC calculator is "all 0s".

4.1.2.5.2. PAD

25

* Application: The CPSPDU of the logical channels except for DTCHs.

* A PAD is used for aligning the length of the CPSPDU with

the integer multiple of the internal encoding unit length or selection combining unit length.

- * The PAD is contained in the CPSPDU for each octet.

- * The bits of the PAD are "all 0s".

5

4.1.2.5.3. Length

- * Application: The CPSPDU of logical channels except for DTCHs.

Length shows an information volume (the number of octets) of the padding in the CPSPDU.

10

4.1.2.5.4. W bits

- * W bits indicate the initial, continuous, or final position of the CPSPDU for each internal encoding unit (for each selection combining unit in the case of an ACCH). The relationships between the bit patterns of the W bits and their indications are shown in Table 8. Examples of usages are shown in Fig. 12.

15

- * A flowchart illustrating a process of assembling the CPSPDU using the W bits is shown in Figs. 97 and 98.

20

[TABLE 8]

W bit pattern

W bits	designated contents
00	continue & continue
01	continue & end
10	start & continue
11	start & end

5 4.1.2.5.5. Internal code.

* An internal code is based on convolutional coding. Fig. 13 shows an convolutional encoder.

* Features of internal coding for respective logical channels are shown in Table 9.

10 * The output of the convolutional encoder is produced in the order of output 0, output 1, and output 2 (a coding rate of 1/2 is applied up to output 1).

* The initial value of the shift register of the encoder is "all 0s".

15

[TABLE 9]

Features of internal encoding.

Types of logical channels	Constraint length	Encoding rate	Depth of interleaving	Number of slots/radio unit
BCCH 1	9	1/2	10	32
BCCH 2			10	32
PCCH			16	4
FACH-L			72	16
FACH-S			72	4 (4 slot interval)
FACH-L			72	16
FACH-S			32	8
SDCCH			30	16
ACCH (32 / 64 kbps)			6	64
ACCH (128 kbps)			10	32
ACCH (256 kbps)			24	16
DTCH (32 kbps)		1/3	24	16
DTCH (64 kbps)			64	16
DTCH (128 kbps)			140	16
DTCH (256 kbps)			278	16
DTCH (512 kbps)			622	16
DTCH (1024 kbps)			1262	16
UPCH (32 kbps)		1/3	30	16
UPCH (64 kbps)			70	16
UPCH (128 kbps)			150	16
UPCH (256 kbps)			302	16

4.1.2.5.6. External encoding.

5 (1) Reed-Solomon encoding/decoding.

* Code form: An abbreviated code RS(36, 32) derived from

a primitive code RS(255, 251) defined over a Galois field GF(28).

* Primitive polynomial: $p = X^8 + X^7 + X^2 + X + 1$.

* Code generator polynomial: $G(x) = (x + \alpha^{120})(x + \alpha^{121})(x + \alpha^{122})(x + \alpha^{123})$

* An external encoding is applied only when unrestricted digital transmission in a circuit switching mode is carried out. The external encoding is carried out every 64 ksps (1B) independently of the transmission rate.

10

(2) Symbol interleaving.

* Interleaving is carried out for each 8-bit symbol unit.

* The depth of the interleaving is 36 symbols independently of the symbol rate of the DTCH.

15

(3) External code handling alignment.

* Each external code handling unit consists of 80 ms long data.

* The external code handling is processed in synchronism with radio frames. The radio frames in the external code handling unit are provided with sequence numbers 0 to 7 in the order of transmission. The external code handling alignment is established in accordance with the sequence numbers. The number of alignment guard stages is as follows (default = 2).

25

The number of forward guard stages: NF (default = 2)

The number of backward guard stages: NR (default = 2)

4.1.2.5.7. Reverse link interfering amount.

* The reverse link interfering amount is reported through the BCCH1 and BCCH2.

- 5 * The reverse link interfering amount is the latest measured value of the reverse interfering amount (total received power including thermal noise) for each sector.

* The macro specifies measurement parameters defining a measuring method.

- 10 * Table 10 shows the correspondence between bit values and reverse interfering amounts. The bits are transmitted starting with the leftmost bit in the table.

* The bits take an idle pattern (see 4.1.10.) when the start of the measurement is not designated by the macro.

15

[TABLE 10]

Correspondence of the bit values to the reverse interfering amounts.

Bit values	Reverse interfering amounts
11 1111	equal to or greater than -143.0 dBm/Hz
11 1111	equal to or greater than -143.5 dBm/Hz
.	less than -143.0 dBm/Hz
.	.
.	.
.	.
00 0001	equal to or greater than -174.0 dBm/Hz
	less than -173.5 dBm/Hz
00 0000	less than -174.0 dBm/Hz

4.1.2.5.8. SFN (System Frame Number)

* The system frame number (SFN) is reported through the
5 BCCH1 and BCCH2.

* The SFN has a one-to-one correspondence with the radio frame, and is incremented by one for each 10 msec long radio frame.

* The SFN of the first of the two radio frames at each
10 transmission timing of the BCCH1 or BCCH2 is transmitted over the BCCH1 or BCCH2. Fig. 14 illustrates an example of transmission of the SFN.

* The base station generates counter values based on timings designated by transmission paths.

* The range of the SFN: 0 to 216-1. A radio frame with SFN=216-1 is followed by a radio frame with SFN=0.

* Bit arrangement: Fig. 15 shows the bit arrangement of the SFN. The bits are transmitted starting with the MSB shown in the figure.

* Uses of the SFN.

(1) For calculating the phase of a reverse link long code: The reverse link long code phase during the originating/terminating connection and during the diversity handover is calculated as will be described in 4.1.3. and illustrated in Figs. 88 to 91 to generate a long code.

(2) For establishing super frame alignment: The radio frame with the SFN of $\text{mod } 64 = 0$ is the initial frame in a super frame, and the radio frame with the SFN of $\text{mod } 64 = 63$ is the final frame in the super frame.

4.1.2.5.9. Transmission power.

* Transmission power is broadcasted over the BCCH1 and BCCH2.

* This parameter indicates the transmission power of the perch channel.

* Range of the value: 6 dBm to 43 dBm.

* Bit arrangement: 6-bit binary notation of a value expressed in a dBm unit (for example, 6 dBm is represented as "000110"). The bits are transmitted starting with the

MSB.

4.1.2.5.10. PID (Packet ID)

* Application: RACH-S/Li; FACH-S/L.

5 * A PID is an identifier for identifying, on a common control physical channel, a call or a mobile station which is associated with transmitted information.

* Information length: 16 bits.

* The PID value on a FACH is designated by the macro together
10 with its transmitted information. The macro notifies the AP of PID value transmitted over the RACH.

* Uses: The major uses of the PID are as follows.

i) For sending a request for establishing the SDCCH and
15 for sending an establishment response.

The PID is used for sending a request for establishment of the SDCCH, from a mobile station to the BTS through the RACH, and an establishment response from the BTS to the mobile station through the FACH. The PID
20 on the FACH that transmits the establishment response is identical to the PID on the RACH that sends the establishment request. The PID value for this purpose is randomly selected by the mobile station.

25 ii) For carrying out packet transmission.

The PID is used for the packet data transmission on the RACH and FACH. The PID value for this purpose is determined

by the base station that selects a unique value for each sector.

* Range of the PID value: A 16-bit range is divided into two parts which are used for the foregoing purposes. Table 5 11 shows an example of the range for each usage.

* Bit structure; PID values (0 to 65535) are represented by the 16-bit binary notation. The bits are transmitted starting with the MSB.

10 [TABLE 11]

Range of PID Values

Uses	Range of values
SDCCH establishment request immediately before SDCCH establishment and establishment response	0 ~ 63
Packet transmission	64 ~ 65535

4.1.2.5.11. Mo.

15 * Mo is a bit for identifying the mode of the FACH-S.

* An example of the bit structure of Mo is shown in Table 12.

[TABLE 12]

20

Bit Structure of MO

Bit	Identification content
0	Normal mode
1	Ack mode

4.1.2.5.12. U/C.

* Application: RACH-S/L, FACH-S/L, and UPCHs of all the
5 symbol rates.

* The U/C bit is an identifier for indicating whether the
information conveyed by the CPSSDU is user information or
control information.

* An example of the bit structure of U/C is shown in Table
10 13.

[TABLE 13]

Structure of U/C Bit

Bit	Identification content
0	User information
1	Control information

15

4.1.2.5.13. TN

* Application: RACH-S/L, FACH-S/L, and UPCHs of all the
symbol rates.

* The TN bit is an identifier for identifying a base station
20 side terminal node of the information conveyed by the
CPSSDU.

* An example of the bit structure of TN is shown in Table 14.

[TABLE 14]

5

Structure of TN Bit

Bit	Identification content	
	RACH, Reverse UPCH	FACH, Forward UPCH
0	MMC-SIM termination	Transmission from MMC-SIM
1	BTS termination	Transmission from BTS

4.1.2.5.14. Sequence Number (S bit)

* Application: RACH

10 * The sequence number is for very efficiently assembling a CPS considering retransmission (layer 1 retransmission) over the RACH between the MS and BTS.

* A range of the sequence number: 0 to 15.

* A CPS is assembled on the basis of the sequence number and the CRC check result.

15

* The sequence number is "0" in the first radio unit of the CPSPDU.

* Fig. 89 illustrates a flow chart of a method of assembling CPSPDU of a RACH using the W bits and S bits.

20

4.1.2.5.15. PD portion.

* Application: PCH.

* The PD portion includes PD1 and PD2, both of which can be used in the same manner.

* The PD portion is an identifier for indicating to a mobile station the presence or absence of incoming call

5 information, and the necessity to receive the BCCH.

Transmitting the PD1 and PD2 at different times enables the mobile station to improve the reception quality owing to the time diversity effect.

* An example of the bit structure of the PD portion is shown
10 in Table 15.

[TABLE 15]

Bit Structure of PN Portion

Bits	Identification contents
all 0s	Incoming call information is present or BCCH reception is necessary.
1	Incoming call information is absent and BCCH reception is unnecessary.

15 4.1.2.5.16. Maximum length of CPSSDU.

The maximum length of the CPUSDU is an LCPS regardless of the types of the logical channels. The LCPS is stored as one of the system parameters.

20 4.1.3. Transmitting and receiving timings of the base station.

*Figs. 88 to 91 illustrate specific examples of the

transmitting and receiving timings of radio frames along with long code phases for each physical channel, when the chip rate is 4.096 Mcps.

* The BTS generates a reference frame timings (BTS reference SFN) from a transmission path.

* The transmitting and receiving timings of various physical channels are established as timings that are offset from the BTS reference SFN. Table 16 shows the offset values of the radio frame transmitting and receiving timings of the physical channels.

* The BTS reference long code phase is determined such that the long code phase becomes zero at the first chip of the frame whose timing corresponds to BTS reference SFN=0.

* The long code phases of various physical channels are set to be offset from the BTS reference long code phase. The offset values of the long code phases of the physical channels are also shown in Table 16.

[TABLE 16]

Physical channels	Transmitting and receiving timings of radio frames	Long code phases
Perch channel	T_{SECT}	T_{SECT}

Forward common control physical	$T_{SECT} + T_{COCH}$	T_{SECT}
Forward dedicated physical channel (during non-DHO)	$T_{SECT} + T_{FRAME} + T_{SLOT}$	T_{SECT}
Forward dedicated physical channel (during DHO)	$T_{SECT} + \langle T_{DHO} \rangle^* - 340 \times C^2$	T_{SECT}
Reverse common control physical channel (RACH)	$(1) T_{SECT} + T_{COCH}$ $(2) T_{SECT} + T_{COCH} + 2560 \times C$ $(3) T_{SECT} + T_{COCH} + 5120 \times C$ \vdots $(16) T_{SECT} + T_{COCH} + 7680 \times C$	$(1) T_{SECT} + T_{COCH}$ $(2) T_{SECT} + T_{COCH} + 640 \times C$ $(3) T_{SECT} + T_{COCH} + 1280 \times C$ \vdots $(16) T_{SECT} + T_{COCH} + 9600 \times C$
Reverse dedicated physical channel (during non-DHO)	$T_{SECT} + T_{FRAME} + T_{SLOT} + 340 \times C$	T_{SECT}
Reverse dedicated physical channel (during DHO)	$T_{SECT} + T_{DHO}$	$T_{SECT} + T_{DHO} - T_{FRAME} - T_{SLOT} - 340 \times C$

*1: $\langle \rangle$ denotes that T_{DHO} which is represented in terms of chips is round down into a symbol based representation.

*2: $340 \times C$ equals the number of chips corresponding to 1/2 slot. Thus, C has different values depending on chip rates: C = 1, 4, 8, 16 for chip rates = 1.024, 4.096, 8.192

and 16.384 Mcps, respectively.

* Although the physical channels other than the perch channel are not provided with the SFN, all the physical channels consider the frame number (FN) corresponding to the SFN of the perch channel. The FN, which is not present physically in a transmitted signal, is generated in a mobile station and the base station for respective physical channels in accordance with the predetermined correspondence with the SFN of the perch channel. The correspondences between the SFN and FN are also shown in Figs. 88 to 91.

* The offset values T_{SECT} , T_{DHO} , T_{CCCH} , T_{FRAME} , and T_{SLOT} will be described here.

15

T_{SECT}

* Offset values T_{SECT} s vary with sectors.

* Each T_{SECT} is applied to all the physical channels in the sector.

20 * The range of the value, which is represented in terms of chips, is within a slot interval.

* The long code phases of the forward dedicated physical channels are all aligned with the offset values T_{SECT} s in order to reduce the interfering amount due to forward link orthogonalization.

25

* Varying the offset values T_{SECT} s between the sectors makes it possible to prevent the long code mask symbols

from taking place at the same time, thereby enabling each mobile station to select its cell appropriately.

T_{CCCH}

- 5 * Each TCCCH is an offset value for a radio frame timing of the common control physical channel.
- * The TCCCH can be set for each common control physical channel. This serves to reduce the occurrence frequency of the matching of transmission patterns between a
- 10 plurality of common control physical channels in the same sector, thereby making the forward direction interfering amount uniform.
- * The range of the value, which is represented in terms of symbols, is within the slot interval. Although the
- 15 value is designated in terms of chips, it is rounded down to a symbol unit of the common control physical channel. The rounded-down value is used for the offset.

T_{FRAME}

- 20 * The TFRAME is an offset value for the radio frame timing of the dedicated physical channel.
- * The TFRAME can be set separately for each dedicated physical channel.
- * The TFRAME serves to make the transmission traffic
- 25 uniform, thereby improving the efficiency of wired ATM transmission.
- * The value is represented in terms of slots (0.625 ms),

and its range is within one radio frame.

T_{SLOT}

* The TSLOT is an offset value for the radio frame timing
5 of the dedicated physical channel.

* The TSLOT can be set separately for each dedicated physical channel.

* The TSLOT serves to prevent the transmission pattern matching, thereby making the interference uniform.

10 * The range of the value, which is represented in terms of symbols, is within the slot interval. Although the value is designated in terms of chips, it is rounded down to a symbol unit of the common control physical channel. The rounded-down value is used for the offset.

15

T_{DHO}

* The TDHO is an offset value for the radio frame timing of the dedicated physical channel and for the reverse link long code phase.

20 * The TDHO corresponds to a measured value of the timing difference between the timing of reverse direction transmission by the mobile station and the timing of reception by the mobile station on the perch channel.

* The range of the value, which is represented in terms
25 of chips, is within the reverse long code phase range (0 to $2^{16}-1$).

* Although in the base station (BTS) the timings of

reception on the reverse physical channels are approximately agree with those in Table 16, they actually fluctuate owing to the propagation delay between the mobile stations and the base station and to variations in propagation delays.

* The radio frame timing of the dedicated physical channel of a reverse link is delayed by half a slot interval compared to that of a forward link. Thus, the delay in transmission power control becomes one slot interval, thereby reducing control errors. More specific setting schemes of the timing differences are illustrated in Figs. 88 to 91.

* With regard to the reverse common control physical channel (RACH).

* The radio frame timing of the RACH is offset from that of the corresponding forward common control physical channel. The offset value has four steps at time slot intervals.

* The initial position of a radio frame is aligned with the initial value of the long code phase. Thus, the long code phase also has 16 offset values.

* A mobile station can carry out transmissions by selecting any one of the 16 offset timings. The BTS can always receive the RACHs simultaneously which are transmitted using all the offset timings.

4.1.4. Spreading code.

4.1.4.1. Generating method.

4.1.4.1.1. Forward long code.

* A forward long code consists of the Gold codes using M sequences obtained from the following generator

5 polynomials.

(Shift register 1) $X^{18} + X^7 + 1$

(Shift register 2) $X^{18} + X^{10} + X^7 + X^5 + 1$

* A configuration of a forward long code generator is shown in Fig. 16.

10 * The initial state of a long code number value is defined as a state in which the value of the shift register 1 represents that long code number, and the value of the shift register 2 is set at "all 1s". Thus, the range of the long code number is 00000h to 3FFFFh. The MSB of the long code
15 number is first input to the leftmost bit of the shift register 1 of the generator in Fig. 16.

* The forward long code has a period of one radio frame interval. Accordingly, the output of the long code generator is truncated at 10 ms so that it repeats the
20 pattern from phase 0 to the phase corresponding to 10 ms. Thus, the range of the phase varies as shown in Table 17 in accordance with the chip rate. In addition, as will be described later in 4.1.5.3., the phase of the inphase component of the long code is shifted from that of the
25 quadrature component by the amount of "shift" (=1,024). Table 17 shows the phases of the two components.

* The long code generator can implement a state in which

its phase is shifted from the initial state by the amount of any number of clocks.

[TABLE 17]

- 5 Correspondence between Chip Rates and ranges of the phase of a forward long code

Chip rates (Mcps)	Ranges of the phase (chips)	
	Inphase component	Quadrature
1.024	0~ 10239	1024~ 11263
4.096	0~ 40959	1024~ 41983
8.192	0~ 81919	1024~ 82943
16.384	0~163839	1024~164863

4.1.4.1.2. Reverse long code.

- 10 * A reverse long code is a Gold code using M sequences obtained using the following generator polynomials.

(Shift register 1) $X^{41} + X^3 + 1$

(Shift register 2) $X^{41} + X^{20} + 1$

- 15 * A configuration of a reverse long code generator is shown in Fig. 17.

- * The initial state of a long code number is defined as a state in which the value of the shift register 1 equals that long code number, and the value of the shift register 2 is set at "all 1s". Thus, the range of the long code number is 00000000000h to 1FFFFFFFFFh. The MSB of the
20 long code number is first input to the leftmost bit of the

shift register 1 of the generator in Fig. 17.

* The reverse long code has a period of 216 radio frame intervals (that is, 210 super frame intervals).

Accordingly, the output of the long code generator is
5 truncated at 216 radio frame intervals so that it repeats
the pattern from phase 0 to the phase corresponding to 216
radio frame intervals. Thus, the range of the phase varies
as shown in Table 18 in accordance with the chip rate. In
addition, as will be described later in 4.1.5.3., the phase
10 of the inphase component of the long code is shifted from
that of the quadrature component by the amount of "shift"
(=1,024). Table 18 shows the phases of the two components.
* The long code generator can implement a state in which
its phase is shifted from the initial state by the amount
15 of any number of clocks.

[TABLE 18]

Correspondence between chip rates and ranges of the phase of a reverse long code

Chip rates (Mcps)	Ranges of the phase (chips)	
	Inphase component	Quadrature component
1.024	$0 \sim 2^{16} \times 10240 - 1$	$1024 \sim 2^{16} \times 10240 + 1023$
4.096	$0 \sim 2^{16} \times 40960 - 1$	$1024 \sim 2^{16} \times 40960 + 1023$
8.192	$0 \sim 2^{16} \times 81920 - 1$	$1024 \sim 2^{16} \times 81920 + 1023$
16.384	$0 \sim 2^{16} \times 163840 - 1$	$1024 \sim 2^{16} \times 163840 + 1023$

5

4.1.4.1.3. Short code.

4.1.4.1.3.1. Short code for symbols other than the long code mask symbols

* The following layered orthogonal code sequences are used for the symbols of all the physical channels except for the perch channels, and for the symbols other than the long code mask symbols of the perch channels.

* A short code consisting of the layered orthogonal code sequences is designated by a code class number (Class) and a code number (Number). The period of the short code varies with short code class numbers.

* Fig. 18 illustrates a method of generating short codes, each of which is represented as $C_{\text{Class}}(\text{Number})$.

* The period of the short codes equals the period of a symbol.

Therefore, if the chip rate (spread spectrum bandwidth) is the same, the short code period varies with the symbol rate, and the number of usable short codes also varies with the symbol rate. The relationships of the symbol rate with
5 the short code class, short code period, and short code number are shown in Table 19.

* The short code numbering system is composed of the code class number and code number.

* The code class number and code number are represented
10 by 4 bits and 12 bits in the binary notation, respectively.

* The short code phase is synchronized with the modulation and demodulation symbols. In other words, the first chip of each symbol corresponds to the short code phase = 0.

[TABLE 19]

chip rate=	Symbol Rate (ksps)			Short code class	Short code period (chips)	Number of short codes
	5 Mcps	10 Mcps	20 Mcps			
1.25 Mcps						
256	1024			2	4	4
128	512	1024		3	8	8
64	256	512	1024	4	16	16
32	128	256	512	5	32	32
16	64	128	256	6	64	64
-	32	64	128	7	128	128
-	16	32	64	8	256	256
-	-	16	32	9	512	512
-	-	-	16	10	1024	1024

4.1.4.1.3.2. Short codes for long code mask symbols.

* Unlike the other symbols, the long code mask symbols of the perch channels use as their short codes the orthogonal Gold codes using M sequences which are obtained using the following generator polynomials.

(Shift register 1) $X^8 + X^4 + X^3 + X^2 + 1$

(Shift register 2) $X^8 + X^6 + X^5 + X^3 + 1$

* Fig. 19 shows a configuration of a short code generator for the long code mask symbols.

* The initial value of the shift register 1 is a short code number NLMS (value range: 0 to 255) for the long code mask symbol. The MSB of the number NLMS is first input in the leftmost bit of the shift register 1.

* The initial value of the shift register 2 is "all 1s".
* If "all 1s" of the shift register 2 is detected, the shift register is halted and "0" is inserted.

* The first chip of the short code output becomes 0.

* The period of the short code is one symbol interval (256 chips) of the perch channel.

4.1.4.2. Method of allocating spreading codes.

4.1.4.2.1. Forward long code.

* In the system operation, all the sectors in a cell share a common single long code number. In the system configuration, different long code numbers can be allocated to respective sectors. The long code number is

designated by the macro.

* With respect to the forward long codes used in the various forward physical channels which are transmitted in the sector, the same long code number is used by the entire
5 physical channels.

* For the long code phase, see 4.1.3.

4.1.4.2.2. Reverse long code.

* A long code number is allocated to each reverse link
10 physical channel. The long code number is designated by the macro.

* Designated physical channels into which the TCH, ACCH, and UPCH are mapped use the reverse link long code allocated to each mobile station. Dedicated physical channels into
15 which the other logical channels are mapped as well as a common physical channel use the reverse link long code allocated to each base station.

4.1.4.2.3. Short codes

20 4.1.4.2.3.1. Short code for physical channels other than the perch channels.

* These short codes are allocated to each forward/reverse link physical channel. The short code numbers are designated by the macro. In terms of the system
25 configuration, the same short code number is simultaneously usable in the same sector.

4.1.4.2.3.2. A short code for the perch channel.

* A short code number for symbols on the first perch channel other than the long code mask symbols is common to all the cells, which is C8(0). (However, any short code
5 designated by the macro is usable for the first perch channel.)

* A short code number for the long code mask symbols of the first perch channel is common to all the cells, which is NLMS = 1. (However, any short code number NLMS
10 designated by the macro for the long code mask symbol is usable for the long code mask symbol of the first perch channel.)

* As a short code number for the long code mask symbol of the second perch channel, one of the short codes that are
15 assigned to the system in advance is used for each sector. The short code numbers of these short codes are stored in the AP of the BSC and in mobile stations. (However, in terms of the hardware configuration, any short code for the long code mask symbol designated by the macro is usable
20 for the second perch channel.)

* The short code number for the long code mask symbol of the second perch channel has one to many correspondences with the forward long codes used in the same sector. Examples of the correspondences are shown in Table 20. The
25 correspondences are stored in the AP of the BSC and in mobile stations. (However, in terms of the hardware configuration, any short code for the long code mask symbol

and any forward long codes which are designated by the macro for the second perch channel are usable in the same sector.)

[TABLE 20]

- 5 Examples of the corresponding of the short codes for the second perch channel with the forward link ling codes.

Short code numbers Nrpc for long code mask symbols on the second perch channel	Forward long codes
2	00001h~00020h
3	00021h~00040h
4	00041h~00060h
5	00061h~00080h

- 4.1.5. A method of generating a spread spectrum modulation
10 signal.

4.1.5.1. Spread spectrum modulation scheme.

Forward/reverse link: QPSK (However, this is also applicable to BPSK).

- 15 4.1.5.2. Method of allocating short codes.

* In accordance with the short code numbering system designated by the macro (code class number Class and code number Number), the same short code is assigned as the inphase short code SCi and the quadrature short code SCq.

- 20 In other words, Sci = SCq = CClass (number).

* Different short code numbering systems are assigned by

the macro to the forward and reverse links, respectively. Accordingly, the forward and reverse links can use different short codes.

5 4.1.5.3. A method of allocating the long codes.

* Long code number LN: Assuming that the output value of the long code generator is $G_{LN}(\text{Clock})$ at the time when the shift registers 1 and 2 of the long code generator are shifted by the clock shift number Clock (0 in the initial state) from the initial state (in which the long code number is set in the shift register 1, and all 1s are set in the shift register 2), the inphase output value $LCi(\text{PH})$ and the quadrature output value $LCq(\text{PH})$ of the long code generator at the long code phase PH shown in Figs. 88 to 10 91 are as follows for both the forward and reverse links.

$$LCi(\text{PH}) = G_{LN}(\text{PH})$$

$$LCq(\text{PH}) = G_{LN}(\text{PH} + \text{Shift}) \quad (=0 \text{ for BPSK})$$

* For the ranges of the inphase and quadrature long code phases, see 4.1.4.1.

20

4.1.5.4. A method of generating a long code + short code.

Fig. 20 illustrates a method of generating an inphase spreading code Ci and a quadrature spreading code Cq using a long code and short code.

25

4.1.5.5. A configuration of a spreader.

Fig. 21 shows a configuration of a spreader for

generating an inphase component S_i and a quadrature component S_q of a spread signal by spreading the inphase component D_i and quadrature component D_q of the transmitted data with the spreading codes C_i and C_q .

5

4.1.6. Random access control.

* Fig. 22 illustrates a random access transmission scheme.

* A mobile station transmits a RACH using a timing which is randomly delayed with respect to the timing for the reception of a frame on the forward common control channel. The random delay amount is one of the 16 offset timings shown in Figs. 88 to 91. The mobile station randomly selects one of the offset timings every time it sends the RACH.

15 * One radio frame is transmitted for each transmission of the RACH.

* Upon detecting an RACH for which no CRC has been detected as a result of the check of each internal encoding unit, the base station uses the ACK mode of the FACH-S to transmit the PID of that RACH in the FACH radio frame following the FACH radio frame that is being transmitted upon the detection of the RACH.

20 * After receiving the ACK for the current radio frame over the ACK mode FACH-S, the mobile station transmits the next radio frame if multiple RACH radio frames are to be transmitted.

* When one piece of CPS information to be transmitted

consists of a plurality of RACH radio units, the mobile station uses the same PID value for all these RACH radio units. In addition, it uses one of the RACH-L and RACH-S, inhibiting mixed use of them for the transmission of one
5 piece of CPS information.

* The mobile station retransmits the RACH if it cannot receive the PID value of the RACH it transmitted, over the ACK mode FACH-S even if TRA msec has passed after the transmission of the RACH. In this case, the mobile station
10 uses the same PID value. The maximum number of retransmissions is NRA (Thus, the same RACH radio unit can be transmitted BRA+1 times at maximum including the first transmission).

* The ACK mode of the FACH-S can contain up to seven PIDs
15 of the RACHs for which no CRC is detected.

* If any RACH is present for which the base station does not detect any CRC and to which it has not yet set back the ACK by the time immediately before the transmission of the FACH radio frame, the base station transmits the
20 ACK mode FACK-S over the first FACH in the order of timings for the reception of RACHS for no CRC is detected. However, those RACHs for which TACK msec has elapsed since the detection of no CRC are excluded from those to be transmitted over the ACK mode FACHS.

25

4.1.7. Multicode transmission.

* The multicode transmission is carried out as follows when

a designated single RL-ID consists of a plurality of dedicated physical channels (spreading codes), so that the pilot coherent detection and transmission power control are carried out collectively for all the dedicated physical channels in the single RL-ID. When a plurality of RL-IDs are assigned to a single mobile station, the pilot coherent detection and transmission power control are carried out independently for each RL-ID.

* In all the physical channels in the single RL-ID, the frame timings match one another and long code phases match one another.

* One or both of the following two methods of transmitting the pilot symbols and TPC symbols are used so as to improve the coherent detection characteristics and to reduce the error rate of the TPC symbols.

Example 1 (see Fig. 23)

* The pilot symbols and TPC symbol are transmitted through one of the plurality of dedicated physical channels in the single RL-ID.

* The pilot symbols and TPC symbol are not transmitted through the other dedicated physical channels.

* The pilot symbols and TPC symbol are transmitted through that one dedicated physical channel at the transmission power a few times greater than the transmission power at which symbols other than the pilot symbols and TPC symbol are transmitted through the dedicated physical channels in the RL-ID.

* The dedicated physical channel for transmitting the pilot symbols and TPC symbol are designated by the macro.

Example 2 (see Fig. 24)

* In all the dedicated physical channels in the single RL-ID,
5 only the pilot symbol and TPC symbol section uses a short code used by a particular dedicated physical channel.

* The particular dedicated physical channel is designated by the macro.

10 4.1.8. Transmission power control.

Figs. 92 to 96 show transmission patterns of the respective physical channels.

4.1.8.1. Perch channels.

15 * The first perch channel is transmitted continuously at designated transmission power $PP1$ except for the long code mask symbol contained in each time slot.

* Through the first perch channel, the long code mask symbol contained in each time slot is transmitted at the
20 transmission power lower than $PP1$ by a designated value P_{down} .

* The first perch channel is always transmitted in the above-mentioned method regardless of the presence or absence of the transmission information of the BCCH1 and
25 BCCH2 which are mapped into the first perch channel. If the transmission information is not present, an idle pattern (PN pattern) is transmitted.

- * Through the second perch channel, only the long code mask symbol contained in each time slot is transmitted without transmitting the other symbols.
- * The long code mask symbol of the second perch channel
5 is transmitted at the same time as the long code mask symbol of the first perch channel. The transmission power has a value PP2 designated by the macro and which is invariable.
- * The values PP1, Pdown, and PP2 are determined such that
10 mobile stations located in contiguous sections can make a sector identification.

4.1.8.2. Forward common control physical channels (FACHs).

- * For a radio frame in which neither the FACH-L nor the
15 FACH-S has transmission information, the transmission is made OFF over the entire period of the radio frame including the pilot symbols.
- * A radio frame in which the FACH-L contains transmission information is transmitted at a transmission power value
20 PFL designated by the macro, over the entire period of the radio frame. The macro designates the transmission power level for each transmission information. This means that the transmission power level is variable with the radio frames. Within each radio frame, the transmission power
25 level is fixed at the transmission power value PFL.
- * If one or more of the four FACH-S'es in a radio frame bear transmission information, only the time slots of the

FACH-S'es including the transmission information are transmitted at a transmission power level designated by the macro. The transmission power value is designated by the macro for each transmission information in "Normal mode" FACHs. This means that transmission power levels PFS1 to PFS4 are variable among the FACH-S'es in the radio frame.

* If all of the four FACH-S'es in a radio frame bear transmission information, the radio frame is transmitted over its entire period. The transmission power, however, is variable with the FACH-S'es.

* The transmission power of the "Ack mode" FACH-S is fixed at a transmission power PACK designated by the macro.

* Of the time slots of a FACH-L or FACH-S that bears transmission information, those located on both sides of a symbol section for a logical channel are designed to transmit pilot symbols without exception. Accordingly, if a time slot of a FACH that bears transmission information is followed by a time slot of a FACH that does not bear any transmission information, the latter time slot must send pilot symbols that are adjacent to the former time slot. The transmission power level of the pilot symbols is made equal to that of the former time slot.

* If two time slots of FACHs that bear transmission information are adjacent to each other, the transmission power of the pilot symbols in the second time slot (that is, the pilot symbols adjacent to the first time slot) is

placed at the level equal to the higher transmission power of the two time slots.

* The values PFL, PFS1 to PFS4 are determined in accordance with the received SIR of the perch channel in a mobile station, which is included in the RACH.

4.1.8.3. Forward common control physical channel (for PCH)

* The two PD portions included in each group are always transmitted in all groups. The transmission power has a transmission power level PPCH designated by the macro.

* When transmitting the PD portion, pilot symbols are transmitted together with the PD portion of the time slot into which the PD portion is mapped. However, the pilot symbols in the subsequent time slot are not transmitted.

* The I portion of each group is divided into four time slots (I1 to I4), and only I portion of a group that contains incoming call information is transmitted. The I portions of the remaining groups without any incoming call information are not transmitted. The transmission power has the transmission power level PPCH designated by the macro.

* The time slot into which the I portions of the group having the incoming call information is mapped is handled such that the pilot symbols are transmitted at both sides of the symbols for the logical channel without exception. Accordingly, if a time slot associated with the I portion of a group having incoming call information is followed

by a time slot associated with the I portion of a group that does not bear any incoming call information, the latter time slot must send only pilot symbols.

* The PPCH value is determined by the AP such that almost
5 all the mobile stations in the sector are capable of receptions.

4.1.8.4. Reverse common control physical channels (RACHs)

* A reverse common control physical channel is transmitted
10 from a mobile station only when there is transmission information. The information is transmitted for every radio frame.

* The transmission powers PRL and PRS of the RACH-L and RACH-S are determined by the mobile station in an open-loop
15 system, and are fixed within a radio frame.

* Pilot symbols are added to the final portion of the radio frame, and the resulting radio frame is transmitted. The transmission power of the pilot symbols is the same as that of the preceding radio frame.

20

4.1.8.5. Forward dedicated physical channel.

* Regardless of whether an originating or terminating call connection or a diversity handover is being carried out, the transmission power control of the forward dedicated
25 physical channel is carried out such that when the forward dedicated physical channel is initialized, the transmission is started at a transmission power value P_D

designated by the macro, and the transmission power is incremented at fixed intervals until the communication power level reaches the value P_D . Then, the transmission power is further incremented at fixed intervals until the
5 receiving synchronization of the reverse dedicated physical channel is established. For details, see

5.2.1.2.2. Until the receiving synchronization of the reverse dedicated physical channel has been established
10 and the decoding of the reverse TPC symbols becomes possible, the transmission is carried out continuously at the fixed transmission power P_D .

* The value P_D is determined by the AP in the same manner as that for the FACH.

15 * When the receiving synchronization of the reverse dedicated physical channel has been established and the decoding of the reverse TPC symbols becomes possible, high speed closed loop transmission power control is started in accordance with the result of decoding of the TPC
20 symbols.

* In the high speed closed loop transmission power control, the transmission power is controlled at a control step of 1 dB for every time slot in accordance with the result of decoding of the TPC symbols. For the details of the method
25 of controlling the transmission power, see 5.2.1.1.

4.1.8.6. Reverse dedicated physical channels.

* In an originating or terminating call connection, a mobile station starts transmission of a reverse dedicated physical channel after a process of establishing receiving synchronization for the forward dedicated physical channel meets predetermined conditions. The transmission power level of the first time slot at the beginning of the transmission is determined in the open loop system as in the case of the RACH. The transmission power level of the subsequent time slots is determined by the high speed closed loop transmission power control in accordance with the result of decoding of the TPC symbols in the forward dedicated physical channel. For the details, see 5.2.1.1.

* In the diversity handover, it is not necessary to establish any new reverse dedicated physical channel. The transmission power is controlled for each time slot by the high speed closed loop transmission power control during the diversity handover. For the details of the method of controlling the transmission power of the reverse dedicated physical channel, see 5.2.1.1.

20

4.2.1.9. DTX control.

The DTX control is applied only to the dedicated physical channels.

25 4.1.9.1. Dedicated physical channels for DTCH and ACCH.

4.1.9.1.1. Transmission.

* Only in the dedicated physical channels (32 ksps) for

voice service, the transmission of symbols for a DTCH is made ON when voice information is present, and made OFF when no voice information is present. Examples of the transmission patterns are shown in Attachment D-5.

5 * The pilot symbols and TPC symbol are always transmitted regardless of the presence and absence of the voice information and control information.

* The power ratio of the transmission power (P_{on}) used while the transmission is ON to the transmission power (P_{off}) used
10 while the transmission is OFF meets the transmission ON/OFF ratio of the transmission characteristics in 5.1.1.

* The transmission ON/OFF patterns are identical in all the 16 time slots in a radio frame.

* The DTX control is carried out for every radio frame (10
15 msec).

* The DTX control is not carried out on the dedicated physical channels (equal to or greater than 64 kbps) for data transmission. Transmissions are always ON for these channels.

20 * The information for notification of the presence and absence of the voice information and control information is not transmitted.

4.1.9.1.2. Reception.

25 * Table 21 shows methods of determining whether or not the voice information and the control information are present.

[TABLE 21]

Methods of deciding the presence and absence of voice information and control information

Information type	Information is present	Information is absent
Voice information	CRC on a DTCH selection combining unit basis is correct; or a power ratio of the average received power of the pilot and TPC symbols to the average received power of the DTCH symbols is equal to or less than P_{DTX} dB.	CRC on a DTCH selection combining unit basis is incorrect; and a power ratio of the average received power of the pilot and TPC symbols to the average received power of the DTCH symbols is equal to or more than P_{DTX} dB.
Control information	CRC on an ACCH selection combining unit basis is correct.	CRC on an ACCH selection combining unit basis is incorrect.

5

* The average received power of the symbols in Table 21 is the average value of the received power of all the associated symbols in the radio frame.

* The value P_{DTX} (dB) is a system parameter.

10

4.1.9.2. Dedicated physical channels for SDCCHs.

* The transmission of symbols for the SDCCH is made ON when

control information to be transmitted is present, and made OFF when no control information is present.

* The pilot symbols and TPC symbol are always transmitted regardless of the presence and absence of the control information.

* The power ratio of the transmission power (Pon) used while the transmission is ON to the transmission power (Poff) used while the transmission is OFF meets the transmission ON/OFF ratio of the transmission characteristics defined in 5.1.1.

* The transmission ON/OFF patterns are identical in all the 16 time slots in a radio frame.

* The DTX control is carried out for every radio frame (10 msec).

* A receiving side carries out the processing in accordance with a method of assembling the CPS-PDU which method is described in Attachment E1. It is not necessary to determine whether the control information is present or not.

20

4.1.9.3. Dedicated physical channels for UPCHs.

* The transmission of symbols for a UPCH is made ON when control information or user information to be transmitted is present, and made OFF when neither of them is present.

* The BTS has three modes for the pilot symbols and TPC symbol. The modes are designated by the macro.

Mode 1.

* The need for transmission is decided for each radio frame. The transmission of all of the pilot symbols and TPC symbol in a radio frame is halted if both the following conditions
5 1 and 2 are satisfied. The transmission of all of the pilot symbols and TPC symbol in the radio frame is restarted if the following condition 3 or 4 is detected.

Condition 1: The time corresponding to F_{NDATA} or more radio frames has passed since all the control information
10 or user information to be transmitted has been transmitted.

Condition 2: The CRC is continuously detected in received F_{CRC} or more radio frames.

Condition 3: Control information or user information to be transmitted occurs.

15 Condition 4: No CRC is detected in the received radio frame.

* A mobile station determines whether the transmission of the pilot symbols and TPC symbol is ON or OFF, using the presence and absence of the control information or user
20 information to be transmitted in connection with the result of detection of an out-of-sync.

* When the control information or user information to be transmitted occurs after the transmission of the pilot symbols and TPC symbol are halted, radio frames into which
25 an idle pattern is inserted in advance are sent using F_{IDL} frames. Then, a radio frame is transmitted into which the control information or user information to be transmitted

is inserted. In this case, the pilot symbols and TPC symbol are also transmitted in the radio frames into which the idle pattern is inserted.

5 Mode 2.

* A radio frame without the control information or user information transmits the pilot symbols and TPC symbol using only some of the slots.

* Slots which transmit the pilot symbols and TPC symbol
10 in the radio frame without the control information or user information are designated using a parameter P_{freq} indicating the frequency of transmissions.

[TABLE 22]

15 Relationships between P_{freq} and slots that transmit pilot symbols and TPC symbol.

P_{freq}	Slot Nos. that transmit pilot and TPC symbols
0	All slots (slots Nos. 1 - 16)
1	1, 3, 5, 7, 9, 11, 13 and 15
2	1, 5, 9 and 13
3	1 and 9
4	1

* The high speed closed loop transmission power control
20 follows only the TPC symbols from the mobile station which are determined in accordance with the pilot symbols and

TPC symbols transmitted by the BTS, while ignoring the TPC symbols from the mobile station which are determined in accordance with the pilot symbols and TPC symbols not transmitted by the BTS. Therefore, the transmission power control intervals vary depending on the P_{freq} values.
* is designated by the macro.

Mode 3

* The pilot symbols and TPC symbol are always transmitted regardless of the presence and absence of the control information or user information.

* With regard to the pilot symbols and TPC symbol in the UPGH symbols and in the mode 1, the power ratio of the transmission power (P_{on}) used while the transmission is ON to the transmission power (P_{off}) used while the transmission is OFF meets the transmission ON/OFF ratio of the transmission characteristics defined in 5.1.1.

* The transmission ON/OFF patterns are identical in all the 16 time slots in a radio frame.

* The DTX control is carried out for every radio frame (10 msec).

* A receiving side carries out the processing in accordance with a method of assembling the CPS-PDU which method is shown in Fig. 97. It is not necessary to determine whether the control information or user information is present or not.

4.1.10. Method of transmitting bits.

- * CRC bits are sent from the higher to lower order bits.
- * The TCH is transmitted in the order of inputs.
- * The tail bits transmitted are all "0s".
- 5 * Dummy bits consist of "1s".
- * The dummy bits are subjected to the CRC encoding.
- * An idle pattern is inserted into all the CRC encoded fields (shadowed portions in Figs. 67 to 87) on a selection combining unit or internal encoding unit basis. These
- 10 fields also include the CRC checking bits. The idle pattern consists of any PN pattern, and the same pattern is used for all the internal encoding units or selection combining units of each logical channel. In addition, the
- idle pattern is designed so that a negative result is
- 15 obtained from a CRC check when no error occurs on the receiving side.

4.1.11. Paging control.

4.1.11.1. BTS operation.

- 20 * Mobile stations are divided into groups in a predetermined manner, and each group is are subjected to paging.
- * An application in the BTS carries out the grouping and designates the corresponding group number via the macro
- 25 together with paging information containing the identification number of a called mobile station. The BTS hardware transmits the paging information using the I

portions (I1 to I4) of the PCH of the designated group number.

* The BTS places "all 0s" in the two PD portions (PD1 and PD2) in the PCHs of the groups having no paging information, and transmits them without transmitting the I portions.

* When instructed by the macro to transmit the paging information, the BTS places "all 1s" in the PD1 and PD2 of the PCH associated with an also designated group number, and transmits the designated paging information using the I portion of the same PCH.

4.1.11.2. The operation of a mobile station.

* A mobile station usually receives only the 8-bit PD1. The mobile station carries out coherent detection using the pilot symbols (four symbols) located immediately before the PD1.

* The mobile station carries out a majority decision process (soft decision). It is assumed that a value computed by the process is "0" when the PD portion is set at all 0s without degrading the receiving quality, and is a positive maximum value when the PD portion is all 1s. The following operations are performed in accordance with the process result and decision threshold values (M1 and M2, where $M1 > M2$).

(1) If the process result is equal to or greater than the decision threshold M1, the mobile station determines that paging has occurred in any of the mobile stations of its

own group, and receives the I portion of the same PCH.

(2) If the process result is less than the decision threshold M2, the mobile station determines that no paging has occurred in its own group, and makes the reception OFF
5 until the receiving timing of the PD1 of its own group one super frame later.

(3) If the process result is equal to or greater than M2 and less than M1, the mobile station receives the PD2 in the same PCH, and carries out the foregoing (1) and (2).
10 If the process result for the PD2 is also equal to or greater than M2 and less than M1, the mobile station receives the I portion of the same PCH.

(4) Receiving the I portion in the foregoing process (2) or (3), the mobile station determines, from the paging
15 information contained in the I portion, whether the paging has occurred in the mobile station or not.

4.2. Transmission path interface.

4.2.1. Major characteristics.

20 4.2.1.1. 1.5 Mbps.

Table 23 shows a summary of the characteristics.
(The summary conforms to JTG. 703 and 704)

Further, Fig. 25 shows the mapping of an ATM cell.
(Mapping of an ATM cell into 1.5MHVY which conforms to
25 G.804)

[TABLE 23]

Item	Content		
Connector	C-G6FA		
Capacity	Four per one BTS		
Pin number		A	B
	3	Input(+) (RIN(+))	Input(-) (RIN(-))
	2	-	Shield earth (GND)
	1	Output(+) (SOUT(+))	Output(-) (SOUT(-))
Input and output impedance	100Ω±10%, balance		
Rate	1.544Mbps		
Transmission code	50% pulse width B8ZS code		
Output pulse	(1) Pulse amplitude: 3.15Vop-±0.38V (2) Pulse width: 324±39nsec		
Signal format (ATM cell mapping)	See Figure 25		
Input level	2.15-3.53Vo-p		
HWY frame sync	Sync scheme: pattern detection one bit shift (multi frame sync code (FAS): 001011) Sync protection: forward four steps, backward two steps		

REC detection condition	(1) 1.5M input stop (2) 1.5M frame out-of-sync (3) Quality degradation (error is surely detected and REC is detected, when bit error ratio is more than or equal to 10^{-4} (CRC-6)).
AIS detection condition	AIS is detected, when there is one or less "0" in 24 frames.
AIS cancellation	When two or more "0" are detected.
RAI detection (SEND) condition	RAI is detected, when pattern "1111111100000000" is detected 16 or more times consecutively in m bits of frame sync signal of forward HWY.
RAI transmission (SEND) condition	When REC and AIS are detected, m bits of frame sync signal of reverse HWY are made to be binary "1111111100000000".

4.2.1.2. 6.3 Mbps.

Table 24 shows a summary of the characteristics.
(The summary conforms to JTG. 703 and 704)

5 Further, Fig. 26 shows the mapping of an ATM cell.
(Mapping of an ATM cell into 6.3MHWY which conforms to G.804)

[TABLE 24]

Item	Content
Connector	Coaxial connector
Capacity	One per one BTS
Pin number	-
Input and output impedance	75Ω
Rate	6.312bps
Transmission code	B8ZS code
Signal format (ATM cell mapping)	See Figure 26
Pulse mask	See Figure 27
HWY frame sync	<p>Sync scheme: pattern detection one bit shift (multi frame sync code: 110010100)</p> <p>Sync protection: forward seven steps, backward three steps (under investigation)</p>
REC detection condition	<p>(1) 6.3M input stop</p> <p>(2) 6.3M frame out-of-sync</p> <p>(3) Quality degradation (error is surely detected and REC is detected, when bit error ratio is more than or equal to 10^{-4} (CRC-5)) (under investigation).</p>
AIS detection condition	AIS is detected, when there is one or less "0" in 96 frames.

AIS cancellation	When two or more "0" are detected.
RAI detection (SEND) condition	RAI is detected, when pattern "1111111100000000" is detected 16 or more times consecutively in m bit pattern of frame sync signal of forward HWY.
RAI transmission (SEND) condition	When REC and AIS are detected, m bits of frame sync signal of reverse HWY are made to be binary "1111111100000000".

4.2.2. Protocol.

4.2.2.1. ATM layer.

Description will be given of the coding of the VPI, VCI, and CID in the ATM layer in the interface between the base station (BS) and the switching center. Fig. 31 shows the structure of the links between the BTS and MCC and SIM.

(1) Interface specifications.

Channel numbers: Channel numbers are assigned to individual HWYs between the base station and the switching center. The correspondences between the physical HWY interface mounted positions and the channel numbers are fixedly set in advance. The range of the channel numbers is 0 to 3 for the 1.5M-WHY, and only 0 for 6.3M-WHY.

VPI: The VPI value is only "0", and the VPI is not used substantially.

VCI: 256/VPI.

CID: 256/VCI.

(2) ATM connection.

- 5 VCI = 64: Used for a timing cell. A minimum channel number is used for each BTS.

The following VCIs can be set as the VSIs other than those used for super frame phase correction. In connection with this, the AAL types used in the respective
10 VCIs are also shown.

* VCIs for control signals between BTS and MCC: AAL-Type 5.

* VCIs for paging: AAL-Type 5.

* VCIs for signals transmitted between MS and MCC: AAL-Type
15 2.

When a plurality of channel numbers are set in the BTS, any number of VCIs other than those used for the super frame phase correction are assignable to any channel numbers.

- 20 The AP uses the macro to establish the correspondence between the VCIs other than those used for the super frame phase correction and both channel numbers and VCI values.

(3) Short cell connection.

- 25 The AP uses the macro to set a method of using the CID value.

(4) The AAL-Type is designated when a wired channel is established. Table 25 shows an example of the correspondence between the transmission information types used by the AP and the AAL-types. However, the hardware
5 can be used to arbitrarily set the correspondence between the transmission information types and the AAL-types.

[TABLE 25]

Example of correspondence between wire channel
10 transmission information types and AAL-Types.

Transmission information types	AAL-Type	VCI types
-----------------------------------	----------	-----------

DTCH transmission information	2	For transmission signals between MS and MCC-SIM
ACCH transmission information	2	
SDCCH transmission information	2	
BCCH1, 2 transmission information	5	For control signals between BTS and MCC-SIM
PCH transmission information	5	For paging
FACH transmission information (for packet transmission) RACH transmission information (for packet transmission) UPCH transmission information		For transmission signals between MS and MCC-SIM
Control signal between BTS and MCC -SIM VCI types	5	For control signals between BTS and MCC-SIM

(5) Idle cells.

As an idle cell on an ATM channel, an idle cell
5 according to ITU-T standard, shown in Fig. 28, is used.

4.2.2.2. All Type2

AAL-Type2 is a protocol of an ATM adaptation layer

of a composite cell (AAL type 2) which is transmitted over an interface (Super A interface) section between the base station and switching center.

5 (1) AAL-Type 2 processor.

Fig. 30 shows a connecting configuration of AAL-Type 2.

(2) Band assurance control.

10 For the Super-A section, control is required which ensures a minimum bandwidth for each quality class in order to meet the required quality for various services (a delay and a cell loss ratio).

* For AAL-Type 2, band assurance is carried out which is
15 assigned to each quality class at a short cell level.

* The short cell quality class falls into the following four classes on the basis of (a maximum allowable delay time and a maximum cell loss ratio).

Quality class 1 (5 ms; 10^{-4})

20 Quality class 2 (5 ms; 10^{-7})

Quality class 3 (50 ms; 10^{-4})

Quality class 4 (50 ms; 10^{-7})

* The quality class which corresponds to the service offered is designated by the macro when a wired channel
25 is established.

* The order of transmission of short cells is determined in accordance with the quality classes, and the required

bandwidth is ensured for each quality class. A specific method of ensuring the bandwidth will be described in 5.3.5.

* When one unit of transmission information is longer than
5 the maximum length of the short cell, the transmission information is divided into a plurality of short cells to be transmitted. In this case, the plurality of short cells are transmitted continuously using the same VCI. The continuity is ensured only within the same VCI, but not
10 ensured between different VCIs. In other words, a standard cell with another VCI can intervene between the short cells to be transmitted.

4.2.2.3. AAL-Type 5

15 AAL-Type 2 and AAL-Type 5 are used as the AAL of ATM cells transmitted on the Super A interface between the base station and switching center. In AAL-Type 5, the SSCOP (Service Specific Connection Oriented Protocol) is supported between the base station and switching center.

20

(1) AAL-5 processor.

Fig. 31 shows a connecting configuration of AAL-5.

(2) Band assurance control.

25

For the Super-A section, control is required which ensures a minimum bandwidth for each quality class in order to meet the required quality for various services (a delay

and a cell loss ratio). The quality classes are shown below.

* For AAL-5, band assurance is carried out which is assigned to each quality class at a VCI level.

- 5 * The quality class falls into the following five classes on the basis of (the maximum allowable delay time and maximum cell loss ratio).

Interrupt (0; 0) Highest priority cell.

Quality class 1 (5 ms; 10^{-4})

- 10 Quality class 2 (5 ms; 10^{-7})

Quality class 3 (50 ms; 10^{-4})

Quality class 4 (50 ms; 10^{-7})

- * The quality class which corresponds to the service offered is designated by the macro when a wired channel
15 is established.

- * The order of transmission of short cells is determined in accordance with the quality classes, and the required bandwidth is ensured for each quality class. A specific method of ensuring the bandwidth will be described in
20 5.3.5.

* The interrupt buffer cell is given the highest priority (with a minimum delay and with discarding inhibited).

4.2.3. Signal format.

- 25 4.2.3.1. The format of AAL-2.

Fig. 32 illustrates the format of AAL-2.

* Start field (one octet).

OSF: Offset field.

SN: Sequence number.

P: Parity.

* SC-H (Short cell header: three octets).

5 CID: Channel identifier: 0/PADDING; 1/ANP;

2-7/RESERVED

LI: Payload length.

PPT: CPS-Packet Payload Type: Includes
start/continue and end information on the payload.

10 UUI: CPS-User to User indication.

When one unit of transmission information is divided
into a plurality of short cells to be transmitted, the
assembly of transmission information on the receiving side
requires consideration to be given to the continuous
15 transmission, using the same VCI, of the UUI and the
plurality of short cells bearing the divided transmission
information.

000/single short cell.

001/top and continued.

20 010/continued and end.

011/continued and continued.

HEC: Header Error Check (generator polynomial = X^5
+ $X^2 + 1$).

* SAL (two or three octets).

25 Fig. 33 shows the format of the SAL.

Table 26 shows a method of specifying SAL fields.

Table 27 shows how the SAL third octet is used.

Table 28 shows conditions for the specification of the SAL fields.

[TABLE 26]

Field	Uses		Set values	Remarks
SAT(SAL type)	SAL field type		00: Wire forward sync state is OK.	
	SAT=1x: Loop Back cell. (LB)		01: Wire forward sync state is NG.	Unused in this system
	SAT=0x: Other than that mentioned above		10: Return indication (forward)	Used in this system
			11: Return indication (reverse)	Used in this system
FN (frame number)	DHO frame alignment	SAT=00	0-63: Frame number	
	Frame number	SAT=01	1-63: Forward FN sliding number.	Used in this system
Sync	Radio out-of- sync detection		1: Out-of-sync state. 0: Sync state.	
BER	BER degradation detection		1: Detect degradation. 0: Normal.	
Level	Level degradation detection		1: Detect degradation. 0: Normal.	
CRC	CRC checking result		1: NG. 0: OK.	
SIR	Received SIR		0-15: Received SIR increases with the value	
RCN (radio channel number)	Radio channel number		0-15: Radio channel sequence number	
RSCN (radio subchannel number)	Radio subchannel number		0-15: Radio subchannel sequence number	

[TABLE 27]

Use and no use of SAL third octet

	During single code communica- tions	During multicode communications	Remarks
Frame in radio channel is not divided.	Both RCN (radio channel number) and RSCN (radio subchannel number) are unused.	Only RCN is used.	
Frame in radio channel is divided.	Only RSCN is used.	Both RCN and RSCN are used.	

5 *The division of the radio channel frame is carried out
when 128 kbps or more unrestricted digital service is pr
vided, and 256 ksps or more dedicated physical channel
is used. The unit of division is the unit, on the basis
of which the external encoding at a user information ra
10 te of 64 kbps (1B) is carried out. See, Figs. 78-80.

*All "0s" is filled when unused.

*The multicode transmission is applied only to the DTCH
and UPCH. Accordingly, RCN is applied only to the DTCH
and UPCH.

15

[TABLE 28]

SAL field specified values

	DICH		AACH		SDOCH		RACH		UPCH	
	R	F	R	F	R	F	R	F	R	F
SAT ^{#1}	0	0	0	0	0	0	0	0	0	0
FN	0	0	0	0	0	0	0	0	0	0
Sync	0	all 0	0	all 0	all 0	all 0	all 0	all 0	all 0	all 0
BER	0	all 0	0	all 0	0	all 0	0	all 0	0	all 0
Level	0	all 0	0	all 0	0	all 0	0	all 0	0	all 0
CRC	0	all 0	all 0	all 0	all 0	all 0	all 0	all 0	all 0	all 0
SIR	0	all 1	0	all 1	0	all 1	0	all 1	0	all 1
RCN ^{#2}	0	0	all 0	all 0	all 0	all 0	all 0	all 0	0	0
RCSN 4	0	0	all 0	all 0	all 0	all 0	all 0	all 0	all 0	all 0

R: Reverse / F: Forward

0: Specify values. See 5.4.3. about a method of specifying concrete values in reverse direction. See MCC-SIM technical description reference about a Specifying method for forward FN.

*1: Only "00" is used.

*2: When specifying a value, it is carried out in accordance with Table 26.

4.2.3.2. Format of AAL-5.

Fig. 34 shows a format of an AAL-5 cell.

A PAD and CPCS-PDU trailer are added to the LAST cell.

5 * PAD (CPCS padding)

The PAD is used for adjusting the frame length to 48 octets (all "0s").

* CPCS-PDU trailer.

CPCS-UU: CPCS user to user indicator.

10 The CPCS is used for transparently transferring information used in a higher layer.

CPI: Common part type indicator.

Uses are not yet defined. All "0s" are set at present.

LENGTH: CPCS-PDU payload length.

15 The LENGTH indicates the length of user information in bytes.

CRC: Cyclic redundancy code. The CRC is used for detecting errors in the entire CPCS frame.

The generator polynomial = $X^{32} + X^{26} + X^{23} + X^{16} + X^{12}$

20 + $X^{11} + X^{10} + X^8 + X^7 + X^5 + X^4 + X^2 + X + 1$.

4.2.3.3. Timing cell.

Fig. 35 illustrates a signal format of a timing cell that is used for a process of establishing SFN (System Frame Number) synchronization when the BTS is started up. Table 25 29 shows a method of specifying information elements in the signal format.

See 5.3.9 for the method of establishing SFN
synchronization with the BTS using the timing cell.

[TABLE 29]

Method of specifying timing cell information elements

Information elements	Specified contents	Specified values
Channel number		0
VPI		0
VCI	VCI for timing cell	64
Message ID	02h: Timing Report (MCC-SIM-BTS) 03h: Timing Report (BTS-MCC-SIM) Other values: reserved	
Correction number	All '0s' (this information element is not used in the present system).	
Correction range	All '0s' (this information element is not used in the present system).	
Transmission delay	All '0s' (this information element is not used in the present system).	
SF time information (received, MCC-SIM side)	Timing cell received time in MCC-SIM. It indicates the time in a super frame. Resolution is 125 μ sec.	Table 30 shows the correspondence between bits and times.
SF time information (transmitted, MCC-SIM side)	Timing cell transmitted time in MCC-SIM. It indicates the time in a super frame. Resolution is 125 μ sec.	
SF time information (received, BTS side)	All '0s' (this information element is not used in the present system).	
SF time information (transmitted, BTS side)	Timing cell transmitted time in BTS. It indicates the time in a super frame. Resolution is 125 μ sec.	Table 30 shows the correspondence between bits and times.
SF phase shift value	All '0s' (this information element is not used in the present system).	

LC counter information (received, MCC-side) SIM	The position of a super frame in a long code period when the timing cell is received in the MCC- (See, Fig. 36-1). SIM	The value ranges over $0-2^{10}-1$, and is represented in binary coding.
LC counter information (transmitted, MCC-side) SIM	The position of a super frame in a long code period when the timing cell is transmitted from the MMC-SIM. (See, Fig. 36).	
LC counter information (received, BTS side)	All "0s" (this information element is not used in the present system).	
LC counter information (transmitted, BTS side)	The position of a super frame in a long code period when the timing cell is received in the BTS (See, Fig. 36).	The value ranges over $0-2^{10}-1$, and is represented in binary coding.
LC counter shift value	All "0s" (this information element is not used in the present system).	
CRC-10	The value of CRC-10 for ATM cell payload. Generator polynomial: $X^{10}+X^8+X^5+X^4+X+1$.	

[TABLE 30]

Correspondence between SF time information bits and times
Bits

Bits	Times (msec)
0h	0
1h	0.125
2h	0.250
:	:
13Fh	639.875

5

4.2.4. Clock generation.

Generated clock (example)

- (1) Radio synthesizer reference clock.
- (2) 4.096 Mcps (chip rate).
- 10 (3) 1/0.625 msec. (radio time slot).

(4) 1/10 msec. (radio frame).

(5) 1/640 msec. (radio super frame; phases 0 to 63).

(6) 1.544 Mbps, 6.312 Mbps (transmission line clock).

5 4.3. Maintenance tool interface

4.3.1. Major characteristics.

Table 31 shows a summary of the characteristics.

[TABLE 31]

Main features

Number	Item	Content	
1	Maintenance tool interface	Communication protocol	RS-232C
		Transmission rate	115.2kbps
		Parity	No
		Bit	Data bit: 8 Stop bit: 1
		X ON/OFF	Yes
		Communication scheme	Full duplex transmission
		DEL code	Treating as BS(08) hexadecimal code
		CR transmission processing	Carriage return + line feed operation for each CR code
		SR reception processing	Carriage return + line feed operation for consecutive CR+LF

4.4. Power supply interface

5 4.4.1. Major characteristics.

Table 32 shows a summary of the characteristics.

[TABLE 32]

Main features

Number	Item	Content
1	Connector	Crimp contact (+, -) × * system FG × one system
2	Input voltage	DC48V (±5V)
3	Input current	Maximum * A per one system
4	Fuse	

5 4.5. Antenna interface.

Table 33 shows a summary of the antenna interface.

[TABLE 33]

Number	Item	Content
1	Connector	N type connector For transmission and reception × 6, for reception × 6
2	Connector placement	Make connector separation equal to or more than 8cm, and do not place connector at position where it is difficult to connect and remove cable. Avoid excessive cable bend, when connecting antenna cable from upper side or lower side.

4.6 Network interface.

The network interface is used to connect to a debug tool.

A 10BASE-T is used as a connector.

5

5. Functional configuration.

5.1. Radio stage, and transmitting and receiving amplifier.

5.1.1. Transmission characteristics

10 Table 34 shows a summary of the transmission characteristics.

[TABLE 34]

Number	Item	Specification
1	Transmission frequency band	2150-2170MHz (provisional value)
2	Transmission and reception frequency interval	190MHz (provisional value)
3	Frequency stability	Equal to or less than $\pm 0.02\text{ppm}$
4	Maximum average transmission power	20W/sector 0.4-20W per one physical channel Total 20W/sector when two carriers are transmitted simultaneously

	(Antenna terminal end)	
5	Transmission power control	Control range: 20dB Control step: 1dB Control period: 0.625ms
6	Modulation scheme	Data: QPSK Spreading: QPSK
7	Frequency band width	5MHz/carrier
8	Chip rate	4.096Mcps (It is easy to extend to 1.024Mcps, 8.192Mcps, 16.384Mcps)
9	Carrier rate	16-1024ksp
10	Short code	256 to 4 chip length
11	Long code length	Forward: 10ms (using $2^{18}-1$ chip length gold code with 10ms length truncation) Reverse: $2^{16} \times 10$ ms (using $2^{41}-1$ chip length gold code with $2^{16} \times 10$ ms length truncation)
12	Neighboring channel leakage power	Equal to or less than -55dB/4.096MHz at 5MHz separation
13	Output impedance	Nominal 500
14	Modulation band	Root Nyquist roll off (corresponding to roll off

	restriction	ratio=0.22)
15	Transmission ON/OFF ratio	Equal to or more than 25dB (Maximum average transmission power is 0.4W, and this condition is satisfied even at the time of VOX ON/OFF under worst transmission power condition in transmission power control) Equal to or more than 70dB (at the time of carrier ON/OFF with 20W output and 50ch multiplexing)
16	Transmission mutual modulation	Equal to or less than -66dB (@ two carrier transmission)
17	Spurious emission	Equal to or less than -66dB
18	Modulation accuracy	Square average value of signal vector error is equal to or less than 12.5%R.M.S.

5.1.2. Receiving characteristics

Table 35 shows a summary of the reception characteristics.

5

[TABLE 35]

Number	Item	Specification
--------	------	---------------

1	Reception frequency band	1960-1980MHz (provisional value)
2	Transmission and reception frequency interval	190MHz (provisional value)
3	Input impedance	Nominal 500
4	Reception frequency stability	Equal to or less than $\pm 0.02\text{ppm}$
5	Reception sensitivity	Equal to or less than -5dBp (static: $\text{BER} = 10^{-3}$)
6	Demodulation scheme	Pilot symbol coherent detection, or demodulation scheme having performance equal to or more than that of pilot symbol coherent detection
7	Diversity	Diversity + RAKE
8	Spurious response	Equal to or more than 60dB (@10Mhz separation)
9	Neighboring channel selectivity	Equal to or more than 33dB (@5Mhz separation)
10	Reception mutual modulation sensitivity	Equal to or more than 60dB (@10Mhz, 20MHz separation)

11	Communication channel transmission characteristics	E_b/N_0 necessary to obtain average BER = 10^{-3} under selective fading with power control: equal to or less than 4dB
12	Control channel transmission characteristics	E_b/N_0 necessary to obtain average frame error ratio = 2×10^{-2} under selective fading with power control: equal to or less than 4dB (@10ms frame)
13	Level measurement	Equal to or more than -14dBp to equal to or less than +50dBp Slot average SIR measurement: 0-30dB
14	Reception sync characteristics	Initial drawing-in characteristics: equal to or less than one frame
15	High rate data transmission characteristics (64k/128k/384kbps)	E_b/N_0 necessary to obtain average BER = 10^{-6} under selective fading with power control and 200ms or less delay: equal to or less than 4dB
16	AGC	Dynamic range: equal to or more than 60dB
17	Number of Fingers	Equal to or more than eight

	able to be received	
--	---------------------	--

*1 A receiving amplifier of the BTS apparatus may be installed at the top of the tower.

*2 Transmission characteristics such as reception
5 sensitivity are separately defined.

*3 Conditions for measurements will be described below.

Static condition: Frequency drift is within the range of ± 0.14 ppm when fading does not occur.

Fading condition: For Rayleigh fading, if the maximum
10 Doppler frequency is 80 Hz, inter-diversity-branch correlation = 0. Frequency stability is considered for the frequency drift.

Selective fading condition: A level of two waves or the like follows Rayleigh fading with a maximum Doppler
15 frequency of 80 Hz. Frequency stability is considered for the frequency drift.

For other measurement conditions, see a separately submitted document relating to test methods.

* The measuring method basically conforms to the Digital
20 Car Telephone System Standard RCR STD27D. For details, see the separately submitted document relating to test methods.

5.1.3. The number of physical channels provided.

25 * The number of physical channels of each type provided per cell is shown below.

Perch channels: 6 (the number of pairs of a first and second perch channels)

Common control physical channels for FACHs: 12

Common control physical channel for PCHs: 12

5 Dedicated physical channels: 300 (in terms of 32 ksps)

* Any number of physical channels of each type can be arranged in any sector provided that the above limit is not exceeded.

10

5.1.4. Pilot coherent detection RAKE

5.1.4.1. Pilot coherent detection RAKE configuration

(1) RAKE combiner

15 Allocate fingers so that sufficient reception characteristics can be obtained for respective diversity branches (space and inter-sector diversities). The algorithm for assigning the fingers to the branches is not specified. The diversity combining method is a maximal ratio combining.

20

(2) Searcher.

A searcher selects paths for RAKE combining from received branches to achieve optimum reception characteristics. The algorithm for selecting the path is
25 not specified.

(3) A method of estimating a pilot coherent detection

channel.

The coherent detection is carried out using pilot blocks (consisting of four pilot symbols each) which are received at intervals of 0.625 ms. The algorithm for
5. estimating a channel is not specified.

5.1.4.2. Channel estimation using multi-pilot blocks.

The method of estimating a channel to improve the reception characteristics is not specified. With
10 reference to Fig. 37, a detailed description will be given of a method of estimating a channel using multiple pilot blocks preceding and following an information symbol section.

Example

15 - Description will be given of a process of estimating a channel for an information symbol section of $-3T_p < t < -2T_p$ which process is executed at the time $t=0$ by averaging three pilot blocks preceding the information symbol section and three pilot blocks following the information symbol
20 section.

(a) Carrying out QPSK demodulation of pilot blocks P1 to P6.

(b) Determining average values of inphase and quadrature components of the four pilot symbols in each of the pilot
25 blocks P1 to P6.

(c) Multiplying the average values by weighting coefficients α_1 to α_3 , and summing the resulting

values up.

(d) Setting the result as the channel estimate of the information symbol section (shadowed part) between the pilot blocks P3 and P4.

5

5.2. Baseband signal processor.

5.2.1. Transmission power control.

5.2.1.1. Outline of the transmission power control.

(1) RACH transmission power control.

10 The BTS broadcasts the transmission power of the perch channels and the reverse interfering power over the BCCH. On the basis of these pieces of information, a mobile station decides the transmission power of the RACH.

15 (2) FACH transmission power control.

 The RACH contains information about the SIR received through the perch channel, which is measured by the mobile station. On the basis of this information, the BTS decides the transmission power of the FACH corresponding to the
20 RACH received, and designates the transmission power level in the hardware together with the transmission information. The transmission power level is variable upon each transmission of the information.

25 (3) Forward and reverse transmission power control of the dedicated physical channel.

 Its initial transmission power is decided in the same

manner as the transmission power of the RACH and FACH. After that, the BTS hardware and mobile station proceed to a high speed closed loop control based on the SIR. In the closed loop control, a receiving side periodically
5 compares the measured value of the received SIR with a reference SIR, and transmits the result of the comparison to the transmitting side using the TPC bit. The transmitting side carries out relative control of the transmission power in accordance with the TPC bit. To meet
10 required receive quality, the AP has an outer loop function to update the reference SIR in accordance with the receive quality. The AP specifies the reference SIR value in the hardware. For the forward link, range control is carried out to set the upper and lower limits of the transmission
15 power level.

(4) Transmission power control during packet transmission.

The transmission power for the UPCH is controlled in
20 the same manner as described above in (3). During a packet transmission, the transmission power for the FACH is controlled in the same manner as described above in (1). During a packet transmission through the FACH, the transmission is always carried out at a transmission level
25 specified by a transmission power range specifying macro. In contrast to the (2) above, the transmission power level is not varied every time the information is transmitted.

5.2.1.2. SIR based high speed closed loop transmission power control.

(1) Basic operation.

5 The BTS (or mobile station) measures the received SIR at every transmission power control interval (0.625 ms). The BTS then sets the TPC bit at "0" when the measured value is greater than the reference SIR or at "1" when the measured value is smaller than the reference SIR. The BTS
10 then transmits the TPC bit to the mobile station (or BTS) using two consecutive bits. The mobile station (or BTS) makes a soft decision for the TPC bit. The mobile station then decreases the transmission power by 1 when the decision result is "0" or increases it when the decision
15 result is "1". The point in time to change the transmission power is immediately before the pilot block. The AP designates the maximum transmission power in the reverse link and the maximum transmission power and minimum transmission in the forward link so that the control is
20 carried out in these ranges (see Fig. 38).

When the TPC bit cannot be received because of out of sync, transmission power value is constant.

(2) Forward/reverse frame timings.

25 Frame timings for the forward and reverse channels are determined such that the positions of the pilot symbols of the two channels are shifted by a 1/2 time slot, thereby

realizing transmission power control with one slot control delay (see Fig. 39).

(3) Initial operation.

5 Fig. 40 shows a method of shifting from the initial state to the closed loop control.

(a) When the AP specifies an initial transmission power value via the macro, the BTS, as the first process of increasing the transmission power, consecutively
10 increases the transmission power by a predetermined magnitude a predetermined number of times at predetermined intervals. At the end of the first process of increasing the transmission power, the transmission power is set at the initial transmission power level designated by the
15 macro. These values are preset as system parameters. The purpose of the first process of increasing the transmission power is to avoid a sharp increase in interfering power in other mobile stations, which may be caused by a rapid transmission at high transmission power.
20 The predetermined values set as system parameters are set so as to increase the transmission power step by step so that other mobile stations can follow variations in the magnitude of the interfering power under the transmission power control. In this case, the TPC bit sequence
25 transmitted over the forward channel has such a fixed pattern (for example, 011011011 ...) that increases the transmission power of the mobile station stepwise. The

pattern is set in advance. If the synchronization of the reverse dedicated physical channel is established during the first process of increasing the transmission power, the process is halted, and the high speed closed loop
5 transmission power control is started in accordance with the received TPC bit from the mobile station.

(b) As the second process of increasing the transmission power, the BTS consecutively increases the transmission power by a predetermined magnitude at predetermined
10 intervals. These predetermined values are specified as system parameters apart from those in the forgoing (a). The purpose of the second process of increasing the transmission power is to ensure the establishment of the forward radio frame alignment by increasing the
15 transmission power step by step even if the initially set transmission power level is insufficient for the mobile station to establish the forward radio frame alignment. The predetermined interval in this process is relatively long and is about one to a few seconds.

20 (c) Establishing the forward frame alignment, the mobile station starts the relative control of the transmission power in accordance with the TPC bits received from the BTS using the transmission power determined in the open loop control as the initial value. In this case, the TPC
25 bits to be transmitted through the reverse channel are determined on the basis of the measured values of the forward SIR.

(d) Establishing the reverse frame alignment, the BTS carries out the relative control of the transmission power in accordance with the TPC bits received from the mobile station.

5

(4) Method of measuring the SIR.

Requirements for the SIR measurement will be described below.

•The transmission power control with one slot control delay
10 can be executed as described above in (2).

•A high SIR measurement accuracy can be achieved.

Examples of measurements are shown below.

(A) Measurement of received signal power (S).

15 (a) The received signal power S is measured for every slot (upon every transmission power update) using pilot symbols resulting from RAKE combining.

(b) The received signal power S equals the amplitude square sum of the average values of the absolute values of the
20 inphase and quadrature components of a plurality of symbols.

(B) Measurement of interfering signal power (I).

(a) Average signal power is determined for the pilot
25 symbols and overhead symbol in a pilot block after the RAKE combining.

(b) The reference signal point for the individual pilot

symbols is determined by carrying out QPSK demodulation (quadrant detection) of the pilot symbols using the root of the foregoing average signal power.

(c) The mean square is determined for the distances between
5 the received points and the reference signal point of the pilot symbols in the pilot block.

(d) The interfering signal power is determined by calculating the moving average of the mean squares over M frames (M: 1 to 100).

10

5.2.1.3. Outer loop.

The BTS and MCC have an outer loop function of updating the reference SIR for the high speed closed loop transmission power control in accordance with quality
15 information in order to meet the required receive quality (average FER or average BER). During the DHO, the MCC controls the outer loop on the basis of the quality resulting from the selection combining.

20 (1) A method of updating the reference SIR.

The initial value of the reference SIR is designated by the AP via the macro.

The subsequent reference SIR is updated on the basis of results of measurement of receive quality. For both
25 MCC and BTS, the AP determines whether or not to update the main reference SIR. A specific method will be described below.

- i) The AP uses the macro to designate the start of the quality monitoring in the hardware.
- ii) The hardware always carries out the quality monitoring designated by the macro (a macro that starts monitoring the presence or absence of the CRC in the MCC-SIM, a macro that starts detecting a decrease in BER, a macro that starts monitoring the presence or absence of the CRC in the BTS, or a macro that starts measuring an estimated value), and reports the results of the quality monitoring to the AP.
- 10 iii) According to the results of the quality monitoring reported by the hardware, the AP determines whether the reference SIR is to be updated or not. If the reference SIR is determined to be updated, the AP specifies the update of the reference SIR in the hardware via a macro setting
- 15 the reference SIR.

5.2.1.4. The transmission power control during the inter-sector diversity handover.

During the inter-sector diversity handover, the

20 measurement of the received SIR and the demodulation of the TPC bits are carried out for both forward and reverse links after the inter-sector maximal ratio combining. For the forward TPC bits, the same value is transmitted from a plurality of sectors. Thus, the transmission power

25 control is carried out in the same manner as in the case where no diversity handover is performed.

5.2.1.5. The transmission power control during the inter-cell diversity handover.

(1) Reverse transmission power control (see Fig. 41).

(a) BTS operation.

5 Each BTS measures the reverse received SIR as in the case where no diversity handover is performed, and transmits, to the mobile station, the TPC bits determined on the basis of the measurement results.

10 (b) Mobile station operation.

 The mobile station receives TPC bits from each BTS independently (while carrying out the inter-sector diversity). At the same time, the mobile station measures the reliability (received SIR) of the TCR bits of each BTS.

15 If any of the results of the soft majority decision about the TPC bits that meet a predetermined reliability is "0", the transmission power is reduced by 1 dB. If all the results are "1", the transmission power is increased by 1 dB.

20

(2) Forward transmission power control (see Fig. 42).

(a) BTS operation.

 Each BTS controls the transmission power in accordance with the received TPC bits as in the case where
25 no diversity handover is performed. If the TPC bit cannot be received because of the out-of-sync of the reverse link, the transmission power level is fixed.

(b) Mobile station operation.

The mobile station measures the received SIR after the site diversity combining, and transmits, to each BTS,
5 the TPC bits which are determined on the basis of the measurement results.

5.2.2. Process of establishing synchronization.

5.2.2.1. At the start up of the mobile station.

10 (a) Each sector sends the perch channel that masks part of the long code. At the start up, the mobile station establishes the perch channel synchronization by carrying out the sector selection using a three step method of initially synchronizing the long code.

15 (b) Each perch channel broadcasts its own sector number and the long codes of the peripheral cells. On the basis of the broadcast information, the mobile station establishes the synchronization, with the perch channels, of the remaining sectors in the same cell and the sectors
20 in the peripheral cells, and measures the reception level of the perch channels. While the mobile station is standing by, the mobile station compares the reception levels of the perch channels with one another to judge whether the mobile station has shifted the sector or not.

25

5.2.2.2. During random access reception.

The mobile station transmits a RACH when registering

a location or making an originating or terminating call. The BTS establishes the synchronization of the RACH transmitted at a plurality of frame offsets, and receives the RACH.

5 As shown in Figs. 88 to 91, the RACH synchronization can be established so that the process of receiving all of the RACH-Ls and RACH-S's that are transmitted using the 16 offset timings per msec can be completed within 0.625 msec. The reception process includes deinterleaving,
10 Viterbi decoding, and CRC decoding, as well as the capability of determining whether Ack must be transmitted or not.

 The BTS measures the propagation delay time associated with bidirectional transmissions between the
15 mobile station and the BTS, using the difference between the point in time when the RACH is received and a predetermined point in time. The BTS then reports the propagation delay time to the AP.

20 5.2.2.3. Upon establishment of the synchronization of the dedicated physical channel (see Fig. 90).

 Now, a brief description will be given of the procedure of establishing the synchronization of the SDCCH and TCH. Fig. 43 illustrates the detailed flow of the
25 process of establishing synchronization.

- (a) The BTS starts transmission of a forward channel.
- (b) The mobile station establishes the synchronization of

the forward channel on the basis of the synchronization information on the perch channel, as well as a frame offset group and a slot offset group which are notified of by the network.

5 (c) The mobile station starts transmission of a reverse channel using the same frame timing as that for the forward channel.

(d) The BTS establishes the reverse channel synchronization on the basis of the frame offset group and slot offset group which are designated by the MCC. In this
10 case, the actual synchronization timings are shifted by the propagation delay time required for bidirectional transmissions between the mobile station and the BTS. Thus, the bidirectional propagation delay time measured
15 during a random access reception can be utilized to reduce the search range for establishing the synchronization.

5.2.2.4. During the inter-cell diversity handover.

For the reverse dedicated physical channel
20 transmitted by the mobile station and the forward dedicated physical channel transmitted by the BTS which originates the diversity handover, even when the diversity handover is started, the radio frame number and long code are continuously counted up as usual and do not change
25 instantaneously. Naturally, the user information is also continuously conveyed, and no instantaneous interruption occurs.

A brief description will be given of a procedure of establishing synchronization when the diversity handover is established (see Fig. 91).

(a) The mobile station measures the difference in frame
5 time between the radio frame transmitted by the mobile
station through the reverse dedicated physical channel and
the radio frame of the same frame number transmitted by
the handover destination BTS through the perch channel.
The mobile station then reports the measurement results
10 to the network. The measured values indicate the time
difference between the frame timing on the reverse
dedicated physical channel and the frame timing on the
perch channel. The measured values are represented in
terms of chips, are always positive, and range from zero
15 to "reverse long code period - 1" chips. For the details
of the measuring method, see "a macro measuring a forward
frame time difference", BTS macro specification.

(b) The mobile station uses the ACCH of the reverse
dedicated physical channel to report the measured values
20 of the frame time difference in the form of a layer 3 signal
to the AP of the BSC though the diversity handover
originating BTS.

(c) The AP of the BSC uses the layer 3 signal to notify
the diversity handover destination BTS of the measured
25 values of the frame time difference along with the frame
offset and slot offset which are set when the incoming or
outgoing call is connected.

(d) Receiving the notification of the measured values of the frame time difference, frame offset, and slot offset, the handover destination BTS starts the transmission of the process of establishing the synchronization of the forward dedicated physical channel being transmitted by the mobile station. See 4.1.3 for specific timings for the transmission of the forward dedicated physical channel and a specific method of establishing the synchronization of the reverse dedicated physical channel.

10

5.2.2.5 Synchronization of perch channels of other sectors in the same cell.

Each sector in the same cell transmits the perch channel which is spread using the same long code and the same short code, while maintaining the phase difference specified by the system. The mobile station receives broadcast information from waiting sectors after completing the initial synchronization. The broadcast information contains the sector number of its own and the number of sectors in the same cell. The mobile station identifies the long code phases of the other sectors in the same cell, and establishes the perch cell synchronization.

25 5.2.2.6. A method of determining whether or not the synchronization of dedicated channels is established.

(a) Chip synchronization.

The BTS knows the reverse long code phase of the channel to be received. The BTS carries out path search, and RAKE reception of paths with high correlation detection values. If the transmission characteristics described in 5.1.2. are satisfied, the RAKE reception can be immediately executed.

(b) Frame alignment.

Since the long code phase has one-to-one
10 correspondence with the frame timing, the frame timing basically need not be searched for. It is enough to check the frame alignment using the frame timing corresponding to the long code phase after the chip synchronization has been established. The frame synchronization of the BTS
15 with the dedicated physical channel is determined to be established when at least SR radio frames run consecutively whose sync words each include at most Nb unmatched bits.

(c) Super frame alignment.

20 Since the dedicated physical channel does not include any bit indicating the FN, the frame number is implicitly determined to establish the super frame alignment.

For the reverse dedicated physical channel, the frame number is set so as to become zero at a time later, by an
25 amount corresponding to the frame offset + slot offset, than the time when the reverse long code phase is zero. This relationship between the long code phase and the frame

number is maintained until the radio channel is released, even if the diversity handover is repeated after the incoming or outgoing call has been connected.

For the forward dedicated physical channel, the frame
5 number is determined such that the radio frame whose timing is shifted by a predetermined time period from the perch channel frame timing is provided with a frame number equal to the SFN of the perch channel, modulo 64. The
predetermined time period equals the frame offset + slot
10 offset while the incoming or outgoing call is being connected as shown in Fig. 90. During the diversity handover, the predetermined time period equals the measured value of the frame time difference - $1/2$ slot -
alpha as shown in Fig. 91. The alpha is an omitted value
15 for expressing the measured value of the frame time difference - $1/2$ slot in terms of a symbol unit.

(2) Resynchronization.

The present system does not possess any special
20 process procedure of establishing resynchronization because the optimum path search by the searcher is equivalent to the execution of constant resynchronization.

25 5.2.3. A method of making a decision for an out-of-phase.

Now, description will be given of the method of making a decision for the out-of-phase state of the BTS in the

radio section of the dedicated physical channel. The two conditions described below are monitored for each radio frame.

Condition 1: Whether or not the number of unmatched bits
5 in a sync word is at most Nb.

Condition 2: Whether or not a CRC is detected on the DTCH selection combining unit basis or on the UPCH internal encoding unit basis.

If at least SR consecutive radio frames run which meet
10 neither of the two conditions, it is determined that the BTS is in the out-of-phase state (the number of forward synchronization guarding stages: SR)

5.2.4. Handover control.

15 5.2.4.1. Inter-sector diversity handover in the same cell.

It is assumed that the number of sectors involved in the inter-sector diversity handover in the same cell is three at maximum.

20 (1) Reverse link.

* The maximal ratio combining is carried out on all the symbols on the physical channel as in the case of space diversity of signals received from a plurality of sector antennas.

25 * The forward transmission power control is carried out using the TPC symbols resulting from the maximum ratio combining.

* The reverse transmission power control is carried out using the receive quality resulting from the maximal ratio combining.

* For the wired transmission, the link establishment and transmission are carried out as in the case where the diversity handover is not performed.

(2) Forward link.

* For each symbol on the physical channel, the same symbol is transmitted from the plurality of sector antennas. The transmission timing control is the same as that in the inter-cell diversity handover. For details, see 4.1.3.

* For the wired transmission, the link establishment and transmission are carried out as in the case where the diversity handover is not performed.

5.2.4.2. Inter-cell diversity handover.

For both forward and reverse links, transmitted and received signals are processed as in the case where the diversity handover is not performed.

5.2.5. Packet transmission control.

5.2.5.1. Applications.

The packet transmission control is applied to the following services.

* TCP/IP packet service.

* Modem (RS-232 serial data transmission) service.

5.2.5.2. Outline.

The purpose of the packet transmission control is to transmit data of various traffic characteristics from low density light traffic to high density heavy traffic while efficiently utilizing radio resources and facility resources. Major features will be described below.

(1) Switching physical channels used in accordance with transmission functions such as traffic.

To effectively use radio resources and facility resources without degrading the quality of service, the physical channels (logical channels) are switched as needed in accordance with the transmission functions such as the traffic volume, which varies with the time.

During light traffic: common control physical channels (FACH and RACH).

During heavy traffic: dedicated physical channels (UPCH).

(2) Switching control of physical channels between the MS and BTS.

The switching control is frequently performed between the physical channels. If the switching control involves the wired transmission control, this will lead not only to an increase in wired transmission control load, wired transmission cost, and control load on the BSC and

MSC but also to an increase in switching control delay, resulting in the degraded quality of service. To avoid this, the switching control is performed only between the MS and BTS, thereby obviating the wired transmission control and the BSC and MSC control.

(3) Inter-cell high speed HHO

It is impossible to carry out the diversity handover at least while the common control physical channel is being used. This is because the transmitting and receiving timings cannot be set freely as in the case of the dedicated physical channel.

In addition, if the normal DHO is applied to the dedicated physical channels during the switching control of the physical channels, it is necessary to control a plurality of BTS'es in switching the dedicated physical channel. This will increase the control load and degrade the quality of service because of an increase in control delay. For this reason, hard handover is employed as a scheme for the packet transmission. However, the HHO is frequently carried out to avoid an increase in the interfering power caused by the hard handover.

Since the HHO is frequently carried out, if the HHO process involves the wired transmission control, this will lead not only an increase in wired transmission control load, wired transmission cost, and control load on the BSC and MSC but also to an increase in HHO control delay,

resulting in the degraded quality of service. To avoid this, the switching control is performed only between the MS and BTS, thereby obviating the wired transmission control and the BSC and MSC control. To avoid this, the wire section uses the diversity handover, whereas only the radio section employs the HHO. Moreover, the HHO control is performed only between the MS and BTS, thereby obviating the wired transmission control and the BSC and MSC control.

10 5.2.5.3. Inter-cell handover control.

* Now, description will be given of a process procedure of inter-cell handover. The process sequence is shown in Fig. 44.

(1) As in the case of the normal DHO, the mobile station selects sectors that meet the diversity handover start conditions on the basis of the levels at which the perch channels are received in the peripheral sectors, and reports these sectors to the BSC via the BTS.

(2) The BSC establishes a wired channel link with the diversity handover destination BTS so that a plurality of links are connected to the DHT, and the wired section is brought into a DHO state.

(3) The mobile station continuously measures, for each BTS, the propagation loss between the BTS and MS using the level at which the perch channel is received in the present location sector and the level at which the perch channel is received in other sectors. The mobile station then

compares the measured propagation losses with one another. If the propagation loss in one of the other sectors undergoing the handover decreases below that in the present location sector and their difference exceeds a

5 predetermined value, the hard handover is determined to be started. Thus, the mobile station first sends the present location sector a request for halting the transmission and reception of the packet data.

(4) After sending a response signal back to the mobile
10 station, the AP of the BTS in the sector in which the mobile station is located uses the macro to halt the transmission and reception of the packet data in the radio section, and releases the radio link. The settings for the wired link, however, remain unchanged.

15 (5) After receiving the response signal from the BTS in the current location sector, the mobile station releases the radio channel to the BTS, and transmits a request signal for transmission or reception of packet data to the BTS in the handover destination sector over the RACH. This
20 signal is transmitted through the physical channel (common control physical channel or dedicated physical channel) which was used by the HO originating BTS.

(6) The HO destination BTS uses the macro to establish a physical channel that is to be set for the packet data
25 transmission on the basis of the information in the received RACH signal that includes information about the physical channel (common control physical channel or

dedicated physical channel) used by the HO originating BTS. The AP does not change the wired link setup but designates the connection between the wired link and radio link in the hardware via the macro.

- 5 * The present process sequence is the same regardless of the physical channel (common control physical channel or dedicated physical channel) used. However, in establishing/releasing a radio link, the process of establishing/releasing the physical channel is required
10 for the dedicated physical channel but not for the common control physical channel.

5.2.5.4. Inter-sector handover control.

Figs. 45 to 48 show examples of the connection
15 configuration during the inter-sector handover.

For the dedicated physical channel (UPCH), the inter-sector DHO is controllable independently of the BTS. Consequently, during a packet transmission, the inter-sector DHO using the maximal ratio combining is
20 carried out for both forward and reverse links as in the case of the circuit switching mode.

For the common control physical channel (EACH and RACH), since the transmitting and receiving timings cannot be set freely, neither the forward nor the reverse links
25 can undergo the maximal ratio combining. For this reason, the switching control is carried out in the BTS and mobile station such that the transmission and reception are

carried out with only one sector in accordance with the propagation loss of the perch channel. The method of switching control is the same as that used in the inter-cell handover process shown in Fig. 44.

5

5.2.5.5. Switching control of the physical channels.

(1) Switching decision node.

The AP of the BTS that covers the location sector of the mobile station makes a decision for the switching on the basis of the following factors.

10

(2) Factors for making a decision for switching

The following factors are available, and the factors to be used are selectable. The factors 1 and 2 are made available to the AP by issuing a macro starting a report on information about the factors, to the AP.

15

Factor 1: In-band information (information about the physical channel which is desired to be used) from the ADP of the MCC-SIM and ADP of the MS.

20

Factor 2: Monitoring of the forward/reverse traffic volume by the BTS.

Factor 3: A layer 3 signal issued by the MS to require the BTS to switch the channel used.

25

(3) A method of making a decision for switching.

The AP makes a decision by comparing the information reported owing to the factors in (3) with thresholds preset

by the AP.

(4) A method of switching control.

* Figs. 49 and 50 illustrate switching sequences.

5 * The switching control is processed only between the mobile station and the BTS without involving the BSC or wired section.

* The control signal used for communications between the mobile station and the BTS is a layer 3 signal, and is
10 processed by the BTS. In this case, the BTS must change the connection between the wired link and the radio link in accordance with instructions from the AP.

5.3. Transmission path interface.

15 5.3.1. Physical interface terminating function.

•Electric level interface

This conforms to the JT-G. 703 interface.

•Cell level interface

20 a) Generation/termination of transmission frames.

In accordance with G.804, ATM cells are mapped using a 6.3M/1.5M transmission path based on the PDH.

At 6.3 M, the ATM cells are transmitted using TS1 to TS96 and without TS97 and TS98. At 1.5 M, they are
25 transmitted using all of TS1 to TS24. In this case, although it is unnecessary to pay attention to delimiters for the 53 bytes of the ATM cells, delimiters for time slots

and octets of the ATM cells are transmitted so that their boundaries align with each other.

On the receiving side, at 6.3 M, the ATM cells are extracted from the TS1 to TS96 while ignoring the data of
5 the TS97 and TS98. At 1.5 M, the ATM cells are extracted from the TS1 to TS24.

b) Cell synchronization establishment.

1) First, to cell boundary is identified. Since the
10 delimiter for each octet is indicated by the physical layer before the cell synchronization, the header error control code is calculated for every four octets using the generator polynomial $X^8 + X^2 + X + 1$ while shifting every other octet. This is repeated until the result is equal
15 to the mod 2 value of the fifth octet value minus "01010101".

2) Once a position is detected at which the HEC (Header Error Correction) value equals the calculation result, a pre-synchronization state is started assuming the
20 position as the header position.

3) Subsequently, the HEC is checked assuming that the next header is located one cell (53 bytes) away from the present header position. Thus, if six consecutive HECs are found to be correct, the synchronization state is started.

25 4) Even in the synchronization state, the operation of checking the HEC is continuously performed on every other cell to monitor the state. Even if HEC errors are detected,

if the number of consecutive HEC errors is less than seven, the synchronization state is maintained by the synchronization guarding. An out-of-sync state is determined to be occurring if seven consecutive HEC errors
5 are detected. The control is then returned to the state of (1) for resynchronization.

c) Cell rate adjustment.

When the ATM cell rate of the ATM layer differs from
10 the transmission path rate as in the case where no cell to be sent is present on the transmission path, the physical interface inserts idle cells for adjusting the cell rate in order to match the two rates with each other.

Since the idle cell has a fixed pattern, its header
15 can be identified by "00000000 00000000 00000000 00000001 01010010". Its pattern in the information field consists of iterative sequences of "01101010" (see Fig. 51).

On the receiver side, the idle cell is used only for cell synchronization without playing any other roles.

20 • Cell level scrambling (applied only to 6.3 M)

1) At the cell level, only information bits are randomized by the generator polynomial $X^{43} + 1$.

2) Descrambling is halted in a hunting state of the cell synchronization.

25 3) The descrambling operates over the number of bits equal to the information field length in the pre-synchronized state and in the synchronization established state, and

halts during the period assumed to correspond to the next header.

4) This function can be enabled or disabled by a hard switch.

5

5.3.2. ATM terminating function.

- ATM cell VPI/VCI identification,

ATM cells have different VCI/VPI for each application or for each user, and are transferred to the respective processing sections by identifying the VPI/VCI.

10

- ATM cell VPI/VCI multiplexing.

For the reverse direction signal, even different VCIs are multiplexed for every VPI. Accordingly, each application outputs its reverse direction ATM cell signal while performing band assurance control.

15

- Cell header structure.

The ATM cell comprises a cell header as shown in Fig. 52. The cell header includes an 8-bit VPI and a 16-bit VCI. The details of coding of these bits are specified separately between the switching system and the base station.

20

- ATM header coding.

25

The order of transmission of bits of the ATM cell is determined such that the bits in each octet are sent

starting with the bit number 8 and that the octets are sent starting with the octet number 1. Thus, the bits are sequentially transmitted starting with the MSB.

For the routing bits of the VPI/VCI, three types of
5 VPIs are specified for the interface between the base station and the switching center. Further, 256 types (8 bits) of VCIs from 0 to 255 are specified for the interface. Thus, the positions of the bits used in the header are as shown in Fig. 53.

10

- Channel number/VPI/VCI setting (initial state).

Channel number: The channel number is fixedly corresponds to the mounted position of an HW interface card and the position of the connector in the card.

15

VPI: The VPI is always "0" (not substantially used)

VCI: The AP specifies the VCI when using the macro to establish a link of a wired transmission path.

5.3.3. AAL-Type 2 control function.

20

- AAL-Type 2 protocol.

The AAL-Type 2 protocol is intended to provide variable rate services that have timing dependence between the transmitting and receiving ends, such as services for voices subjected to variable rate coding.

25

- a) Service types (Required conditions and the like).

The AAL-Type 2 needs to transfer data to the higher

layer between the transmitting and receiving sides in real time at a variable rate under particular timing conditions. In addition, the AAL-Type 2 needs to transfer information required to match the clock and timing between the transmitting and receiving sides and to transfer information on data structures.

b) Functions of AAL-Type 2

The AAL-Type 2 must use timing conditions similarly to the AAL-Type 1, provide a multiplexing function for multimedia multiplexing of data and voices, and execute processes for handling a variable rate, cell loss, and cell priority.

5.3.4. Procedure of separating a forward direction signal.

- A forward direction signal can be separated into a control signal and a traffic signal by first identifying the AAL type. The AAL types include AAL-2 and AAL-5 and can be identified using the VCI (see 4.2.2.1.).
- Different VCIs are provided for the control signal used between the BTS and MCC-SIM during an AAL-5 connection and the super frame phase correction cell. Accordingly, the signal and the cell are also separated from each other using the VCI.
- For the AAL-2 connection, users are identified using CIDs. Since the CID varies with calls, separation is carried out using the CIDs.

5.3.5. Band assurance control.

- Fig. 54 illustrates an outline of the band assurance control.

- 5 • The band assurance control determines the order of transmissions of short cells and standard cells in accordance with the quality classes described below, to establish the respective bands. More specifically, on the basis of the precondition that the short cells and standard
- 10 cells are discarded if they exceed a maximum tolerable delay time, the band assurance control determines the order of transmissions of short cells and standard cells for the respective quality classes such that the cell loss ratio has a maximum value. The order of transmissions is
- 15 specified by the macro.

- For the VCs to which the AAL-Type 5 is applied, a macro setting a MATM connection ID associates the VCI with one of the AAL-Type 5 quality classes described below.

- 20 • For the VCs to which the AAL-Type 2 is applied, the macro setting a MATM connection ID associates the VCI and CID with one of the AAL-Type 2 quality classes described below.

5.3.5.1. Quality classes.

5.3.5.1.1. AAL-Type 5 quality classes.

- 25 • There are six requirements for the quality classes of the AAL-Type 5 as shown below. Table 36 shows the correspondence between services and the quality classes.

In practice, the quality class is set when a connection for the wired transmission path is established using the macro. However, the timing cell VC is always given top priority (the delay time is 0 ms and the loss rate is 0).

5 (maximum tolerable delay time; allowable cell loss ratio)

(top priority of 0 ms delay; loss ratio 0)

(5 ms; 10^{-4})

(5 ms; 10^{-7})

10 (50 ms; 10^{-4})

(50 ms; 10^{-7})

(AAL-Type 2)

5.3.5.1.2. AAL-Type 2 quality classes.

15 • There are four requirements for the quality classes of the AAL-Type 2 as shown below. Table 36 shows the correspondence between services and the quality classes. In practice, the quality class is set when a connection for the wired transmission path is established using the
20 macro.

(maximum tolerable delay time; allowable cell loss ratio)

(5 ms; 10^{-4})

(5 ms; 10^{-7})

25 (50 ms; 10^{-4})

(50 ms; 10^{-7})

• When there are a plurality of AAL-Type 2 VCs as shown

in Table 28, the assignment of the bands to the AAL-Type 2 quality classes can be varied with the VCs. In other words, the different orders of transmissions of the short cells can be set for the respective VCs.

5

5.3.5.2. Function to assure bands for reverse direction signals.

- For the reverse direction signals, it is necessary to carry out both a band assurance at an AAL-Type 2 level and a band assurance at an ATM cell level including the AAL-Type 2 and the AAL-Type 5. Fig. 56 illustrates a process of assembling reverse direction co-transmitted cells of the AAL-Type 2 level. Fig. 55 shows a procedure of transmitting the reverse direction ATM cell.
- When the BTS is started up, the cell transmission sequence data is specified in association with the quality classes. In accordance with the cell transmission sequence data, short cells and standard cells to be transmitted are selected from the quality classes and then multiplexed to obtain transmission cells. If no cells of the target quality are present in the buffer, a cell of the next quality can be transmitted.
- According to the tolerable delay times determined for the individual quality classes, a cell in the buffer that exceeds the tolerable delay time of its class is discarded.
- Fig. 57 illustrates cell transmission sequence data corresponding to Table 36.

A transmission cycle of A, B, C, ...L is determined in connection with assigned bands A, B, C, ... H. (Example: A, C, A, D, A, F, A, C, ...)

5 Moreover, for E, F, ...K, L, the order of transmissions is determined with which the short cells are combined together so as to meet the respective quality classes. (Example: F2, F1, F2, F3, F4, ...)

10 If there are no cells in the target class, a cell with the next priority is transmitted. * Cells of an interruption class are always given top priority.

[TABLE 36]

Correspondence between services and quality classes.

ATM quality classes (Tolerable delay, Cell loss ratio)	SC quality classes (Tolerable delay, Cell loss ratio)	Services	ATM band	SC band
(Top priority)	-	Timing cell	-	-
(5ms, 10^{-7})	-	No Corresponding Service in experiment	A	-
(5ms, 10^{-4})	-	No Corresponding Service in experiment	B	-
(50ms, 10^{-7})	-	Control signal between BTS, MMC and SIM, Paging signal	C	-
(50ms, 10^{-4})	-	No Corresponding Service in experiment	D	-
AAL-Type 2 VC1	(5ms, 10^{-7})	unrestricted 32 kbps	E	E1
		unrestricted 64 kbps or more		
	(5ms, 10^{-4})	voice		E2
	(50ms, 10^{-7})	ACCH (all symbol rates)		
		Packet		E3
	(50ms, 10^{-4})	Modem		E4
AAL-Type 2 VC2		Fax	F	
	(5ms, 10^{-7})	unrestricted 32 kbps		F1
		unrestricted 64 kbps or more		
	(5ms, 10^{-4})	voice		F2
	(50ms, 10^{-7})	ACCH (all symbol rates)		
		Packet		F3
	(50ms, 10^{-4})	Modem		F4
		Fax		

5.3.6. AAL-Type 5 + SSCOP function.

• Service types.

- 5 The AAL-5 is a simplified AAL type that is provided for transferring signaling information. The AAL-5 differs from the other AAL types in that its payload has no head trailer and can thus transfer 48 bytes with a

minimum communication overhead.

• Functions of the AAL-5

The AAL-5 does not detect errors in every cell but
5 in every user frame in order to efficiently transmit data.
Errors are detected using CRC-32 check bits. The CRC is
given to each user frame. Since the CRC is composed of
32 check bits, it has a high detection capability enough
to operate effectively even in an environment with a
10 degraded transmission quality.

Fig. 58 shows the format of the AAL-Type 5.

The receiving side performs the following
operations.

- 1) The receiving side checks the value of the PT (Payload
15 Type) in the ATM header to identify the delimiters in the
data.
- 2) The receiving side then checks the extracted payload
by calculating the CRC.
- 3) The receiving side identifies the user data by verifying
20 the LENGTH information.

• SSCOP protocol sequence (link establishment and
release).

The SSCOP does not transfer acknowledge or flow
25 control information on the data frame between the base
station and switching center but completely separates the
role of the data frame from that of the control frame. Fig.

60 illustrates an example of the sequence from the establishment to release of the SSCOP link.

5.3.7. Function to add a reverse direction delay.

- 5 • SSCOP is applied to the control signal VC and paging VC used between the BTS and MCC, and is processed by the hardware of the BTS and MCC-SIM.

The function to add a reverse direction delay is provided for measuring system immunity by adding delays to reverse signals during tests in which reverse signals between different base stations are combined together.

A delay of up to 100 ms can be added to the reverse signal at 0.625 msec steps (frame offset steps).

The delay amount can be set by a dip switch.

15

5.3.8. Loop back function.

(1) HWY loop back function.

A loop back operation can be performed in 1) in Fig. 60 in accordance with an instruction from the hard switch.

20

(2) Loop back by the macro for each VC

A loop back operation can be performed in 2) in Fig. 60 only for the VCIs corresponding to MATM connection IDs specified by the macro.

25

(3) Loop back by the macro for each VC

A loop back operation can be performed in 3) in Fig.

60 only for the VCIs corresponding to MATM connection IDs specified by the macro.

5 5.3.8. Function to generate a reference timing (function to synchronize radio frames)

5.3.8.1. SFN synchronization.

When started up, the BTS, together with the MCC-SIM, executes a process of establishing time synchronization of SFNs (System Frame Numbers) which process will be
10 described below. The SFN clock generated by the MCC is the master clock of the whole system. The object of the present process is to allow the BTS to establish the time synchronization with the SFN clock of the MCC-SIM. The target upper limit value for errors in time synchronization
15 is 5 msec. The BTS uses the SFN clock resulting from the establishment of synchronization, as its internal clock. The timings for the transmitting and receiving radio channels in each sector under the control of the BTS are generated on the basis of the reference SFN clock of the
20 BTS. (See Figs. 88 to 91.)

The SFN synchronization is established by exchanging the timing cells between the MCC-SIM and BTS. Fig. 61 shows the procedure of the establishment, which will be described below in detail. The numerals in Fig. 61 correspond to
25 the numbers in the following description.

(1) When powered on or started up after a reset, the BTS generates a temporary SFN clock signal.

(2) The BTS acquires a transmission time (a time within a super frame, and the position of the super frame within a long code period) of a timing cell 1 to be transmitted to the MCC-SIM. The transmission time is based on the temporary SFN clock signal.

(3) The BTS generates the timing cell 1. Values for information elements contained in the timing cell 1 are set as shown in Table 37.

10 [TABLE 37]

Information elements	Specified values
Message ID	03h; Timing Report (BTS→MCC)
SF time information (received, MCC-SIM side)	all 0
SF time information (transmitted, MCC-SIM side)	all 0
SF time information (transmitted, BTS side)	The time within the super frame in the time information acquired in (2).
LC counter information (received, MCC-SIM side)	all 0
LC counter information (transmitted, MCC-SIM side)	all 0
LC counter information (transmitted, BTS side)	The super frame position in the long code period in the time information acquired in (2).
Other information elements	In accordance with Table 26.

(4) The BTS transmits the timing cell 1 generated in (3), at the transmission time acquired in (2).

15 (5) The MCC-SIM receives the timing cell 1, and acquired

the received time (the time within the super frame, and the position of the super frame within a long code period). This time is based on the SFN clock generated by the MCC-SIM.

- 5 (6) The MCC-SIM acquires a transmission time (a time within a super frame, and the position of the super frame within a long code period) of a timing cell 2 to be transmitted to the BTS. The transmission time is based on the temporary SFN clock signal generated by the MCC-SIM.
- 10 (7) The MCC-SIM generates the timing cell 2. Values for information elements contained in the timing cell 2 are set as shown in Table 38.

[TABLE 38]

Information elements	Specified values
Message ID	02b; Timing Report (MCC→BTS)
SF time information (received, MCC side)	The time within the super frame in the time information acquired in (3).
SF time information (transmitted, MCC side)	The time within the super frame in the time information acquired in (6).
SF time information (transmitted, BTS side)	The time within the super frame in the time information acquired in (2) (The MCC sets this information element in the timing cell received in (5) to the same value again).
LC counter information (received, MCC side)	The super frame position in the long code period in the time information acquired in (3).

15

LC counter information (transmitted, MCC side)	The super frame position in the long code period in the time information acquired in (6).
LC counter information (transmitted, BTS side)	The super frame position in the long code period in the time information acquired in (2) (The MCC sets this information element in the timing cell received in (5) to the same value again).
Other information elements	In accordance with Table 26.

(8) The MCC-SIM transmits the timing cell 2 generated in (7), at the transmission time acquired in (6).

5 (9) The MCC-SIM receives the timing cell 2, and acquired the received time (the time within the super frame, and the position of the super frame within a long code period). This time is based on the SFN clock generated by the MCC-SIM.

10 (10) The BTS calculates the corrected value X of the temporary SFN clock phase from the information elements of the received timing cell 2. Fig. 62 illustrates the method of calculating the corrected value as well as the basis of the calculation of the corrected value.

15 In Fig. 62,

SF BTS-1: SF time information about the transmission of the timing cell 1 by the BTS

LC BTS-1: LC counter time information about the transmission of the timing cell 1 by the BTS

20 SF MCC-1: SF time information about the reception of the timing cell 1 by the MCC-SIM

LC MCC-1: LC counter time information about the

reception of the timing cell 1 by the MCC-SIM

SF BTS-2: SF time information about the reception of the timing cell 2 by the BTS

LC BTS-2: LC counter time information about the
5 reception of the timing cell 2 by the BTS

SF MCC-2: SF time information about the transmission of the timing cell 2 by the MCC-SIM

LC MCC-2: LC counter time information about the transmission of the timing cell 2 by the MCC-SIM

10 (11) The BTS counts the number of corrections, calculates corrected values, and increments the counter each time it stores the corrected value.

(12) The BTS stores an upper limit N of the number of corrections as one of the system parameters. The BTS
15 iterates the foregoing (2) to (11) until the counter value exceeds the upper limit N. N is at most 255.

(13) When the number of corrections reaches the upper limit N, a statistical process is executed on the stored results of the calculation of the corrected values. (The
20 statistical process temporarily selects the maximum value from the results of the calculation.) The BTS shifts its temporary SFN clock by the corrected value calculated by the statistical process, thus correcting the SFN clock of the BTS.

25 (14) Upon completing these operations, the BTS lights up an ACT lamp on the HWY interface card of the BTS assuming that the SFN time synchronization has been established

between the BTS and MCC-SIM.

If the synchronization is not yet established even a predetermined time after the start of the transmission of the timing cell, the BTS stops the transmission of the timing cell, and lights up an ERR lamp on the card having the transmission path interface. In addition, the BTS brings the SFN timing into a free-running state, and controls the transmission in the radio section in accordance with the self-running SFN.

10

5.3.9.2. Synchronization holding function

- * The BTS can generate the reference clock from the HWY and then various clock signals from the reference clock.
- * When the BTS is connected to a plurality of 1.5 M HWYs, it can use a hard switch such as a dip switch to select the HWY used to generate a clock.
- * After establishing the SFN time synchronization upon start up, the BTS generates a reference SFN clock on the basis of only the clock generated from the HWY. If a restart process is not executed, the reference SFN clock of the BTS will not be changed by any other factors. The BTS does not autonomously correct the SFN synchronization. Further, the BTS does not execute a synchronization correcting process triggered by a request for synchronization corrections made by the MCC.

15

20

25

5.4. Method of transferring information transmitted

between the MCC-SIM and the MS

A method of transferring, within the BTS, information transmitted between the MCC-SIM and the MS varies depending on the type of the logical channels in the radio section.

- 5 The processing method will be described below. The description below has nothing to do with the information transmitted between the MCC-SIM and BTS.

5.4.1. Correspondence between radio links and wired links.

- 10 For the correspondence between radio section links (physical channels and logical channels) and wired section links (channel number, VPI, VCI, and CID), see the macro specification or Attached Document "Examples of Links".

- 15 5.4.2. Method of processing transmission information.

5.4.2.1. Forward direction.

Table 39 shows, for each logical channel, a method of processing the transmission information received from the wired section.

20

[TABLE 39]

Processing method of transmission information received
from wire section

Logical channel	Description
DTCH	<p>*Assembles a radio unit from the transmission information in a received short cell, and transmits it in a radio frame with the same frame number as the FN in the SAL of the short cell.</p> <p>*Discards the user information in the received short cell if the transmission to the wire section is not completed before the expiration of a timer ADTCH which is started when the short cell is received.</p> <p>*The value of the timer ADTCH is specified as one of the system parameters in the range from 0.625 msec to 540 msec at every 0.625 msec step.</p> <p>*Transmits transmission patterns of the minimum transmission rate as for a radio frame that does not receive any transmission information from the wire section.</p>

ACCH	<p>*Assembles, when one radio unit is placed in one radio frame (in the case of a 256 kbps dedicated physical channel), a radio unit from the transmission information in a received short cell, and transmits it in a radio frame with the same frame number as the FN in the SAL of the short cell.</p> <p>*Assembles, when one radio unit is placed in a plurality of radio frames (in the case of 128 kbps or less dedicated physical channel), a radio unit from the transmission information in a received short cell, and transmits it beginning from a radio frame with the same frame number as the FN in the SAL of the short cell, followed by the remainder of the plurality of the successive radio frames.</p> <p>*Discards the user information in the received short cell if the transmission to the wire section is not completed before the expiration of a timer AACCH which is started when the short cell is received.</p> <p>*The value of the timer AACCH is specified as one of the system parameters in the range from 0.625 msec to 640 msec at every 0.625 msec step.</p> <p>*Transmits transmission patterns without ACCH as for a radio frame that does not receive any transmission information from the wire section.</p>
SDCCH	<p>*Assembles the CPD PDU for the transmission information in a received short cell, carries out dividing processing at every internal encoding unit, performs processings up to assembling of a radio unit, and transmits it in a radio frame that can be transmitted first.</p> <p>*The controller of the MCC transmits the control information on a CPS-SDU unit basis with spacing such that the rate of the SDCCH in the radio section is not exceeded. Thus, it is enough for a receiving buffer of the information from the SDCCH wire transmission path to have an area that can accommodate only a few frames corresponding to the CPS-SDU with a maximum length.</p>

FACH (for packet transmission)	<p>*Assembles the CPD PDU for the information in a received short cell or in a standard cell, carries out dividing processing at every internal encoding unit, performs processings up to assembling of a radio unit, and transmits it in a radio frame that can be transmitted first. If divided into a plurality of internal encoding units, a plurality of radio units are transmitted successively.</p>
UPCH	<p>*The EM-interface for packets of the MCC transmits the control information on a CPS-SDU unit basis with spacing such that the rate of the UPCH in the radio section, which rate is required at the call setup as a peak rate, is not exceeded. Thus, it is enough for a receiving buffer of the information from the UPCH wire transmission path to have an area that can accommodate only a few frames corresponding to the CPS-SDU with a maximum length. In a state in which the FACH is established, because the rate of the radio section can be lower than the peak rate, a FACH buffer must have a rather large size.</p> <p>*Makes OFF the transmission of the UPCH symbols as for a radio frame that does not receive any transmission information from the wire section.</p>

5.4.2.2. Reverse direction.

Table 40 shows, for each logical channel, a method of processing the transmission information received from
5 the radio section.

[TABLE 40]

Processing method of transmission information received
from radio section

Logical channel	Description
DTCH (32 kbps dedicated physical channel)	<p>*Assembles a short cell upon receiving a radio frame, and transmits it to the wire section at a timing as early as possible.</p> <p>*The following two modes are prepared for the transmission to the wire section. The mode is designated each time a radio link is established.</p> <p>Mode 1:</p> <p>As with the radio frame to which the information presence or absence decision of 4.1.9.2. gives a result that no transmission information is present, transmission to the wire section is not carried out.</p> <p>Even if the CRC check for each selection combining unit produces an incorrect result, if the information presence or absence decision of 4.1.9.2. gives a result that transmission information is present, the transmission information is sent to the wire section after the viterbi decoding.</p> <p>Mode 2:</p> <p>Transmission information is always sent to the wire section after the Viterbi decoding.</p>
DTCH (64 kbps or more dedicated physical channel)	<p>*Assembles a short cell upon receiving a radio frame, and transmits it to the wire section at a timing as early as possible.</p> <p>*Transmission information is always sent to the wire section after the Viterbi decoding.</p>
ACCH	<p>*Assembles a radio frame from ACCH bits in one or more radio frames, and carries out the Viterbi decoding and CRC checking. Assembles a short cell immediately only when the CRC checking produces a correct result, and transmits the short cell to the wire section at a timing as early as possible.</p> <p>*Discards the received information if the CRC checking produces an incorrect result, and does not carry out any transmission to the wire section.</p>

SDCCH	<p>*Carries out the Viterbi decoding and CRC checking for the transmission information in a radio frame. Generates the CPS PDU in accordance with the W bits only when the CRC checking is correct. Assembles a short cell when the generation of the CPS PDU is completed and the CRC checking of the CPS is correct, and sends it to the wire section at the earliest timing available.</p> <p>*Discards the received information if the CRC checking for each internal encoding unit produces an incorrect result, so that it is not involved in generating the CPS. In this case, the CPS PDU is discarded in its entirety, and the transmission to the wire section is not carried out.</p>
RACH (for packet transmission)	<p>*Carries out the Viterbi decoding and CRC checking for the transmission information in a radio frame. Generates, for only the transmission information with TN bit = 0, the CPS PDU in accordance with the W bits and S bits only when the CRC checking is correct. Assembles a short cell when the generation of the CPS PDU is completed and the CRC checking of the CPS is correct, and sends it to the wire section at the earliest timing available.</p>
UPCH	<p>*Discards the received information if the CRC checking for each internal encoding unit produces an incorrect result, so that it is not involved in generating the CPS. In this case, the CPS PDU is discarded in its entirety, and the transmission to the wire section is not carried out.</p>

5.4.3. Method of setting the SAL.

Now, description will be given of a method of setting the SAL in a short cell or standard cell when sending reverse direction transmission information from the radio section to the wired section. See Table 22 for a fundamental setting method.

10 5.4.3.1. SAT

SAT is always set at "00" for all logical channels.

5.4.3.2. FN

(1) DTCH

* The FN of a received radio frame is used as the FN of the SAL of the short cell or standard cell including the transmission information transmitted by the radio frame.

5 * As illustrated in Fig. 81, the first chip of the radio frame of FN=0 is shifted from the position of the reverse long code phase = 0 by the sum of the frame offset value and the slot offset value selected during an originating or terminating call connection, and this relation is not
10 changed by the iteration of the DHO. Thus, the FN of the received radio frame is determined on the basis of the reverse long code phase using the following expression.

$$FN = ((PTOP - POFS)/C) \bmod 64$$

where PTOF denoted the phase of the first chip of the
15 received radio frame, POFS denotes the sum of the frame offset value and the slot offset value, and C denotes the number of chips per radio frame, where $C = 10240, 40960, 81920, \text{ or } 163840$ (chip rate = 1.024, 4.096, 8.192, or 16.384 Mcps).

20

(2) ACCH

* When a single radio unit overlays a plurality of radio frames (in the case of 128 ksps or less dedicated physical channels), the FN of the first of the plurality of radio
25 frames is used as the FN in the SAL.

* A method of deciding the FN of the radio frame is the same as that of the foregoing (1).

(3) SDCCH, RACH, and UPCH.

* The FN of the first of one or more radio frames constituting the CPS-PDU is used as the FN in the SAL.

- 5 * A method of deciding the FN of the radio frame is the same as that of the foregoing (1).

5.4.3.3. Sync.

(1) DTCH, UPCH, and SDCCH.

- 10 * The sync is set to "0" if the received radio frame remains synchronized and to "1" if it is in the out-of-sync state.
* For the details of the process executed in the out-of-sync state, see 5.4.4. below. For the out-of-sync determining method, see 5.2.3.
- 15 * When one CPS-PDU consists of a plurality of radio frames in the UPCH or SDCCH, the sync is set to "1" only if all the radio frames are out-of-sync.

(2) ACCH and RACH.

- 20 * The sync is set to "0".

5.4.3.4. BER.

(1) DTCH.

- * The value of the BER is set on the basis of the result
25 of the determination for an increase in BER estimated value for each radio frame.

(2) ACCH.

* The value of the BER is set on the basis of the result of the determination for an increase in BER estimated value for each radio frame.

5

(3) SDCCH, UPCH, and RACH.

* The value of the BER is set on the basis of the result of the determination for an increase in BER estimated value for each CPS-PDU.

10

5.4.3.5. Level.

(1) DTCH.

* The value of the Level is set on the basis of the result of the determination for a decrease in level for each radio frame.

15

(2) ACCH.

* The value of the Level is set on the basis of the result of the determination for a decrease in level for each radio frame.

20

(3) SDCCH, UPCH, and RACH.

* The value of the Level is set on the basis of the result of the determination for a decrease in level for each CPS-PDU.

25

5.4.3.6. CRC

(1) DTCH.

* The value of the CRC is set on the basis of the result of the CRC check for each selection combining unit.

5 (2) ACCH.

* The value of the CRC is set on the basis of the result of the CRC check for each radio unit.

(3) SDCCH, UPCH, and RACH.

10 * The value of the CRC is set on the basis of the result of the CRC check for each CPS-PDU. However, since the transmission to the wire link is carried out only when no CRC is detected, the CRC value is substantially always "0".

15 5.4.3.7. SIR

(1) DTCH.

* The value of the SIR is set on the basis of the result of the SIR measurement for each radio frame.

20 (2) ACCH.

* The value of the SIR is set on the basis of the result of the SIR measurement for each radio frame.

(3) SDCCH, UPCH, and RACH.

25 * The value of the SIR is set on the basis of the result of the SIR measurement for each CPS-PDU (if the CPU-PDU covers a plurality of radio frames, the average value for

the plurality of radio frames is used as the result).

5.4.3.8. RCN and RSCN.

The values of the RCN and RSCN are set in accordance
5 with Table 24.

5.4.4. A method of processing during the out-of-sync decision.

Table 33 shows a process executed for each logical
10 channel when the BTS is determined to be out-of-sync by
the method of making a decision for the out-of-sync as
described in 5.2.3. In this case, the RACH will not be
described because the out-of-sync decision is not applied
to the common control physical channel.

15

[TABLE 41]

Logical	Description
DTCH SDCCH	*Generates a cell whose Sync bit in the SAL is set at "1", and sends the short cell to the wire section every 10 msec interval until the synchronization is recovered.
UPCH	*A short cell of the UPCH does not include user information. *The remaining bits of the SAL are as follows: SAT: 00 FN: As an estimated value, one of the values 0-63 is set which is incremented at every 10 msec interval. It is set such that it keeps continuity from before the out-of-sync decision. BER: 1 Level: 1 CRC: 1 SIR: all 0s RCN, RSCN: according to Table 27 (as in the synchronization holding state).
ACCH	*Halts transmission to the wire section.

5 5.4.5. Function to detect a cell loss.

If the forward data from the MCC-SIM does not reach the BTS because of a cell loss in the ATM section, the location at which the cell loss is occurring is identified using the parameters described below. Fig. 63 illustrates the flow of detection of a cell loss.

- Frame number (FN): Used to detect a cell loss in all the unrestricted services.

- Radio subchannel number (RSCN): Used in unrestricted services (128 kbps or more unrestricted services) having two or more internal encoding CRC providing units within a period of 10 ms.

5 • Radio channel number (RCN): Used when the internal encoding CRC providing unit exceeds the user payload length of the short cell, that is, 42 octets when either the RCN or RSCN is used or 43 octets when neither of the RCN and RSCN is used.

10 The cell loss is detected using these four parameters.

Table 42 shows a process executed when a cell loss is detected.

15 [TABLE 42]

Processing method of cell loss detection

Logical channel	Processing method
DTCH	*Inserts dummy data (all "0s") for each short cell in the cell loss portion, assembles one or more radio frames and transmits them.
ACCH	*Not necessary to consider the cell loss.
SBCCH FACH (for packet transmission) UPCH	*Discards the entire CPS-EDU including as its part the cell loss portion.

5.5. Control portion (BTS-CNT)

5.5.1. Outline of functions.

The BTS-CNT portion comprises the functions shown in Tables 43 and 44.

5 [Table 43]

Function of BTS-CNT portion

Number	Item	Function
1	Function of controlling radio portion, base band signal processing portion	(1) Function of controlling radio portion, base band signal processing portion based on macro instruction from AP or MT (2) When starting up BTS, reading system parameter by itself from SDM described below, and after starting up, conducting operation in accordance with the system parameter.
2	Function of controlling transmission path	(1) Function of setting and releasing connection provided by AAL-Type 2 and Type-5 based on macro instruction from AP or MT
3	Function of processing base station control	(1) Function of conducting transmission and reception of control signal generated by AP

	signal	<p>or MT with MCC-SIM station</p> <p>(2) Under the following condition, function of conducting predetermined processing without producing loss of signal. At this time, making signal delay as small as possible.</p> <ul style="list-style-type: none"> - 50 byte signal occurs for each of reverse and forward directions 300 times per second. - Implementing 300 channels
4	Two mode operation function	<p>Enabling operation in the following two modes</p> <p>(1) System experiment mode</p> <ul style="list-style-type: none"> * Function of operating as apparatus employing application software made by NTT DoCoMo * Connecting demonstration system made by DoCoMo to maintenance tool interface <p>(2) Debug mode</p> <p>Function of conducting transmission experiment by</p>

		<p>employing application software made by hardware manufacturer, specifying macro and inputting macro parameter to MT, and specifying debug of macro operation and a plurality of macro instructions</p> <p>* Software employed in MT is also made by hardware manufacturer.</p> <p>* Enabling MT by returning return code of macro</p> <p>** mode switching is conducted by reset of BTS. Mode can be selected by hard switch, and application program (made by DoCoMo or hardware manufacturer) of selected mode is loaded at start-up.</p>
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[Table 44]

Function of BTS-CNT portion (continued)

Number	Item	Function
5	Function of conducting transmission and reception with maintenance tool	<p>(1) Function of conducting switching control experiment without AP by inputting macro and macro parameter from maintenance tool</p> <p>(2) Function of making registration in non-volatile memory by inputting system parameter from maintenance tool</p> <p>(2) Function of reporting various information to maintenance tool</p> <p>(3) Function of relaying control signal between AP and MT</p>
6	SDM function	<p>(1) Function of storing application program (AP), macro program, system parameter, and AP operation information for system experiment which are read at start-up in non-volatile memory.</p> <p>(2) Function of loading the above-mentioned various data</p>

		<p>read at start-up to non-volatile memory from PC card described below or network.</p> <p>(3) Function for individually storing application program for each mode in different area of memory. Function for further storing AP operation information for system experiment in the different area.</p> <p>(4) Loading can be conducted at any timing after start-up.</p>
7	Function of reading PC card	<p>(1) Function of loading data by using PCMCIA Rev.2.1/JEIDA Ver.4.2 Type II and Type III.</p> <p>(2) PC card is 20Mbyte ATA-compliant Flush Memory.</p> <p>(3) Function for individually storing application program for each mode in different area of memory on single PC card. Function for further storing system parameter and AP operation information for</p>

		<p>system experiment in the different area.</p> <p>(4) Figure 65 shows memory assignment of PC card.</p>
8	System parameter	<p>(1) It can be changed at any timing after start-up by using system parameter setting macro.</p> <p>(2) Even if system parameter is changed, it is not necessary to make radio link which has already been set by RL-ID setting macro conform to the changed parameter. Radio link set by RL-ID setting macro after system parameter is changed operates in accordance with the changed parameter without reset.</p>

5.5.2. Debug mode.

5.5.2.1. Maintenance tool.

The maintenance tool refers to a notebook type PC
5 connected to a maintenance tool interface and software mounted in the PC. The maintenance tool is used as a man machine interface in tests on macro operations and experiments on transmissions. It enables the setting of the macros issued by the BTS and their parameters.

Required functions will be described below.

(1) The maintenance tool can display the names of all the macros for the BTS so that the user can select one of the macros to be issued.

5 (2) The maintenance tool can display all the input parameter items for the selected macro so that the user can input data for each item.

(3) For those of the input parameter items for which values must be inputted, the maintenance tool displays the ranges
10 of the values. For items for which selections must be made, the maintenance tool enables the user to make the selections.

(4) After all the parameters for the selected macro have been inputted, the maintenance tool can instruct the macro
15 to be issued.

(5) The maintenance tool can instruct the macro to be issued. Further, after the BTS main body has issued the macro, the maintenance tool can immediately display an end code returned by the OS.

20 (6) For macros that allow values to be returned by e-mail, as soon as the value is returned from the OS, the maintenance tool displayed the returned value on the screen. In this case, the maintenance tool also displays the meaning of the returned value in accordance with the macro
25 specification. The maintenance tool also displays the time at which the returned value arrived at the maintenance tool.

(7) The maintenance tool can simultaneously display the macro to be issued and the selections for the input parameter items (see the foregoing (1) to (4)) as well as the end code and returned value from the OS. Moreover,
5 the maintenance tool can also display only the returned value.

(8) The maintenance tool has a log function to enable the saving of history of issued macros, their input parameters, end codes, and returned values. The maintenance tool
10 records all these data as one file and generates the file so that the recorded items can be distinguished from one another.

(9) A signal format used by the maintenance tool interface has only to obey the description, in the macro
15 specification, of the macro transmitting data to the maintenance tool. Any format can be used which makes debugging application software consistent with the software on the maintenance tool.

(10) The maintenance tool can edit a scenario that enables
20 macros to be consecutively and sequentially issued. The scenario has the following functions.

- i) Function to register macros and macro parameters to be consecutively issued.
- ii) Function to execute branching in accordance with the
25 returned value and end code, sent by e-mail.
- iii) Function to enable the same macro to be issued a number of times within a series of scenarios and to enable

different macro parameters to be set for the respective issuances.

v) Function to halt an operation and restart it when the corresponding key is depressed.

5 vi) Forced end function.

(11) The OS is the Windows 95 or Windows NT.

(12) The maintenance tool comprises a notebook computer having a 3.5-inch floppy disk, a hard disk (at least 1 Gb), a color monitor, and an RS232C terminal.

10

5.5.3. Application software for a debug mode.

On the assumption that a common RTOS and a common macro program are used regardless of the mode, the present application software can provide an environment in which
15 tests on macro operations and experiments on transmissions can be executed.

Fig. 66 shows an example of a procedure of debug operations performed between the maintenance tool and RTOS/macro program. The procedure will be described below
20 in detail.

(1) The maintenance tool is instructed on a macro to be issued and its macro parameters.

(2) Information on the macro instructed to be issued and its macro parameters is transmitted via the maintenance
25 tool interface.

(3) The macro program delivers the information on the macro and its macro parameters which information has been

received from the maintenance tool, to the application program (AP) using the e-mail function of a macro starting reception of data from the maintenance tool.

(4) In accordance with the received information, the AP
5 issues the specified macro to the macro program using the specified parameters.

(5) The macro program returns an end code for the issued macro to the AP and executes a macro process.

(6) The AP sets information on the received end code in
10 a buffer for the macro transmitting data to the maintenance tool. The AP then issues the macro to the macro program.

(7) The macro program transmits, from the maintenance tool interface, the contents of the buffer for the macro transmitting data to the maintenance tool.

15 (8) The maintenance tool receives the information on the end code from the AP, and then displays the end code and its meaning on the screen.

6. Hardware configuration conditions.

20 (1) A card having a baseband processing section for each physical channel has an indicator installed at a position that can also be confirmed during mounting; the indicator indicates the usage of the physical channels in the hardware. The usage is the ratio of the number of physical
25 channels being set to the maximum number of physical channels that can be handled by the hardware. The maximum number of physical channels that can be handled by the

hardware can vary depending on the symbol rate.

Accordingly, the usage is displayed in terms of 16-ksp/s physical channels. The indicator is lighted up when a hardware resource is obtained using a macro setting an

5 RL-ID.

(2) Each card is provided with an ACT lamp, an ERR lamp, and an ALM lamp. After being powered on or reset, the ACT lamp is correctly started up and then lighted up. When a defect is detected to disable the operation, the ALM lamp
10 is lighted up. If a defect is detected but the operation is not disabled, the ERR lamp is lighted up. Detailed lighting conditions should be specified and submitted to Docomo.

(3) A SEND and REC lamps are installed in a card used to
15 transmit and received signals to and from an external node. When a signal is received from the external node, the REC lamp is lighted up. When a signal is transmitted to the external node, the SEND lamp is lighted up. The lamps are lighted up for about several hundred msec.

20 (4) The sector antenna can be freely connected to the card having the baseband processing section for each physical channel.

(5) The whole BTS can be reset. A system reset switch can be installed. Moreover, each card can be reset. A local
25 reset switch is installed in each card.

(6) Testing hard terminal

Table 45 shows a list of hard terminals required for

testing and debugging.

[Table 45]

List of hard terminals

Hard terminal type	Remarks
Data output terminal for analyzing packet	Regarding output data and its format, see BTS macro specification 426, data output start macro for analyzing packet. Interface connector: 10BASE-T, 10Mbps Ethernet
Transmission RF, IF monitor terminal	Connector shape and mounting position are not specified.
Reception IF monitor terminal	Connector shape and mounting position are not specified.
Transmission I/O monitor terminal	Connector shape and mounting position are not specified.
Reception I/O monitor terminal	Connector shape and mounting position are not specified.
Terminal for measuring delay profile	Terminal for connecting measuring apparatus which can measure and display delay profile. Measuring method, measuring apparatus, connector shape, and mounting position are not specified.
Reception TPC bit monitor terminal	TPC bit (0 or 1) for each slot of received reverse individual physical

	channel is output.
Transmission TPC bit monitor terminal	TPC bit (0 or 1) for each slot of transmitted forward individual physical channel is output.
Clock output terminal for MS-SIM	Cunning clock for MS-SIM is output. Details are T.B.D.

[Advantageous Results of the Invention]

As described above, the novel base station apparatus
in the mobile communication system according to the present
5 invention is best suited for high speed CDMA digital
communications.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1]

Fig. 1 is a block diagram showing a functional
10 configuration of a base station in accordance with the
present invention.

[Fig. 2]

Fig. 2 is a diagram illustrating a structure of a
logical channel.

15 **[Fig. 3]**

Fig. 3 is a diagram illustrating a structure of a
physical channel.

[Fig. 4]

Fig. 4 is a diagram illustrating signal formats of
20 the physical channel.

[Fig. 5]

Fig. 5 is a diagram illustrating format of reverse common control physical channel signal.

[Fig. 6]

5 Fig. 6 is a diagram illustrating correspondence between physical channels and logical channels.

[Fig. 7]

Fig. 7 is a diagram illustrating a mapping example of a logical channel onto a perch channel.

10 [Fig. 8]

Fig. 8 is a diagram illustrating a PCH mapping scheme.

[Fig. 9]

Fig. 9 is a diagram illustrating a FACH mapping scheme.

15 [Fig. 10]

Fig. 10 is a diagram illustrating a mapping of DTCH and ACCH onto a dedicated physical channel.

[Fig. 11]

Fig. 11 is a diagram illustrating ACCH mapping scheme.

20 [Fig. 12]

Fig. 12 is a diagram illustrating a method of using W bits;

[Fig. 13]

25 Fig. 13 is a block diagram showing a configuration of a convolutional encoder.

[Fig. 14]

Fig. 14 is a diagram illustrating an SFN (system frame

number) transmission example.

[Fig. 15]

Fig. 15 is a diagram illustrating a structure of SFN bits.

5 [Fig. 16]

Fig. 16 is a block diagram showing a configuration of a forward long code generator.

[Fig. 17]

Fig. 17 is a block diagram showing a configuration of a reverse long code generator.

[Fig. 18]

Fig. 18 is a diagram illustrating a short code generating method.

[Fig. 19]

15 Fig. 19 is a block diagram showing a configuration of a short code generator for a long code mask symbol.

[Fig. 20]

Fig. 20 is a block diagram showing a spreading code generating method using a long code and short code.

20 [Fig. 21]

Fig. 21 is a block diagram showing a configuration of a spreader.

[Fig. 22]

Fig. 22 is a diagram illustrating a random access transmission scheme.

[Fig. 23]

Fig. 23 is a diagram illustrating an example of a

multicode transmission method;

[Fig. 24]

Fig. 24 is a diagram illustrating another example of a multicode transmission method;

5 [Fig. 25]

Fig. 25 is a diagram illustrating a frame structure for 1544 kbits/s used for transmitting ATM cell.

[Fig. 26]

Fig. 26 is a diagram illustrating a frame structure
10 for 6312 kbits/s used for transmitting ATM cell.

[Fig. 27]

Fig. 27 is a diagram illustrating a pulse mask at an output terminal of a /JT-G703 6312 kbits/s system.

[Fig. 28]

15 Fig. 28 is a diagram illustrating a structure of an idle cell.

[Fig. 29]

Fig. 29 is a diagram illustrating an example of a link structure (ATM connection) between a BTS and MCC.

20 [Fig. 30]

Fig. 30 shows a connecting configuration of AAL-Type 2.

[Fig. 31]

Fig. 31 shows a connecting configuration of AAL-Type
25 5.

[Fig. 32]

Fig. 32 is a diagram illustrating an AAL-2 format.

[Fig. 33]

Fig. 33 is a diagram illustrating a SAL format.

[Fig. 34]

Fig. 34 is a diagram illustrating an AAL-5 format.

5 [Fig. 35]

Fig. 35 is a diagram illustrating a signal format of a timing cell.

[Fig. 36]

10 Fig. 36 is a diagram illustrating super frame positions.

[Fig. 37]

Fig. 37 is a diagram illustrating transmission line estimation using multiple pilot blocks.

[Fig. 38]

15 Fig. 38 is a diagrams illustrating SIR based closed loop transmission power control.

[Fig. 39]

Fig. 39 is a diagram illustrating transmission power control timings.

20 [Fig. 40]

Fig. 40 is a diagram illustrating transition to the closed loop transmission power control.

[Fig. 41]

25 Fig. 41 is a diagram illustrating reverse transmission power control during inter-cell diversity handover.

[Fig. 42]

Fig. 42 is a diagram illustrating forward transmission power control during inter-cell diversity handover.

[Fig. 43]

5 Fig. 43 is a flowchart illustrating a synchronization establishment flow of a dedicated physical channel.

[Fig. 44]

Fig. 44 is a sequence diagram illustrating an example of an inter-cell diversity handover processing in packet
10 transmission.

[Fig. 45]

Fig. 45 is a diagram showing an example of a connection configuration during an inter-sector handover in a reverse dedicated physical channel (UPCH).

15 [Fig. 46]

Fig. 46 is a diagram showing an example of a connection configuration during an inter-sector handover in a forward dedicated physical channel (UPCH).

[Fig. 47]

20 Fig. 47 is a diagram showing an example of a connection configuration during an inter-sector handover in a reverse common control physical channel (RACH).

[Fig. 48]

Fig. 48 is a diagram showing an example of a connection configuration during an inter-sector handover in a forward common control physical channel (FACH).
25

[Fig. 49]

Fig. 49 is a diagram illustrating an example of a switching sequence from a common control physical channel to a dedicated physical channel.

[Fig. 50]

5 Fig. 50 is a diagram illustrating an example of a switching sequence from a dedicated physical channel to a common control physical channel.

[Fig. 51]

10 Fig. 51 is a diagram illustrating a format of an idle cell.

[Fig. 52]

Fig. 52 is a diagram illustrating a format of a cell header.

[Fig. 53]

15 Fig. 53 is a diagram showing a routing bit using position.

[Fig. 54]

Fig. 54 is a diagram illustrating an outline of the band assurance control.

20 [Fig. 55]

Fig. 55 is a flowchart illustrating ATM cell transmission control.

[Fig. 56]

25 Fig. 56 is a flowchart illustrating an AAL type 2 cell assembling processing.

[Fig. 57]

Figs. 57 are diagrams illustrating examples of cell

transmission sequence data.

[Fig. 58]

Fig. 58 is a diagram illustrating an example of an AAL type 5 format.

5 [Fig. 59]

Fig. 59 is a diagram illustrating an example of a SSCOP sequence.

[Fig. 60]

Fig. 60 is a diagram illustrating an intersection
10 point in the BTS.

[Fig. 61]

Fig. 61 is a flowchart illustrating a procedure of establishing SFN time synchronization in a BTS.

[Fig. 62]

15 Fig. 62 is a diagram illustrating a BTSSFN clock phase compensation value calculation method.

[Fig. 63]

Fig. 63 is a flowchart illustrating a cell loss detection process.

20 [Fig. 64]

Fig. 64 is a diagram illustrating a configuration of software of each mode.

[Fig. 65]

Fig. 65 is a diagram illustrating a memory allocation
25 of PC cards.

[Fig. 66]

Fig. 66 is a diagram illustrating a debugging

operation.

[Fig. 67]

Fig. 67 is a diagram illustrating a coding scheme of a BCCH1 or BCCH2 (16 ksps) logical channel;

5 [Fig. 68]

Figs. 68 are diagrams illustrating a coding scheme of a PCH (64 ksps) logical channel.

[Fig. 69]

Fig. 69 is a diagram illustrating a coding scheme of
10 a FACH-long (64 ksps) logical channel.

[Fig. 70]

Fig. 70 is a diagram illustrating a coding scheme of a FACH-short (normal mode) (64 ksps) logical channel.

[Fig. 71]

15 Fig. 71 is a diagram illustrating a coding scheme of a FACH-short (Ack mode) (64 ksps) logical channel.

[Fig. 72]

Fig. 72 is a diagram illustrating a coding scheme of a RACH-long (64 ksps) logical channel

20 [Fig. 73]

Fig. 73 is a diagram illustrating a coding scheme of a RACH-short (64 ksps) logical channel.

[Fig. 74]

Fig. 74 is a diagram illustrating a coding scheme of
25 an SDCCH (32 ksps) logical channel.

[Fig. 75]

Fig. 75 is a diagram illustrating a coding scheme of

an ACCH (32/64 ksps) logical channel

[Fig. 76]

Fig. 76 is a diagram illustrating a coding scheme of
an ACCH (128 ksps) logical channel;

5 [Fig. 77]

Fig. 77 is a diagram illustrating a coding scheme of
an ACCH (256 ksps) logical channel;

[Fig. 78]

Fig. 78 is a diagram illustrating a coding scheme of
10 a DTCH (32 ksps) logical channel;

[Fig. 79]

Fig. 79 is a diagram illustrating a coding scheme of
a DTCH (64 ksps) logical channel;

[Fig. 80]

15 Fig. 80 is a diagram illustrating a coding scheme of
a DTCH (128 ksps) logical channel;

[Fig. 81]

Fig. 81 is a diagram illustrating a coding scheme of
a DTCH (256 ksps) logical channel;

20 [Fig. 82]

Fig. 82 is a diagram illustrating a coding scheme of
a DTCH (512 ksps) logical channel;

[Fig. 83]

Fig. 83 is a diagram illustrating a coding scheme of
25 a DTCH (1024 ksps) logical channel;

[Fig. 84]

Fig. 84 is a diagram illustrating a coding scheme of

an UPCH (32 kbps) logical channel;

[Fig. 85]

Fig. 85 is a diagram illustrating a coding scheme of
an UPCH (64 kbps) logical channel;

5 [Fig. 86]

Fig. 86 is a diagram illustrating a coding scheme of
an UPCH (128 kbps) logical channel;

[Fig. 87]

Fig. 87 is a diagram illustrating a coding scheme of
10 an UPCH (256 kbps) logical channel;

[Fig. 88]

Fig. 88 is a diagram illustrating transmission
timings of a perch channel and common control physical
channel.

15 [Fig. 89]

Fig. 89 is a diagram illustrating transmission
timings of a reverse common control physical channel
(RACH).

[Fig. 90]

20 Fig. 90 is a diagram illustrating transmission and
reception timings of a dedicated physical channel (during
non-DHO).

[Fig. 91]

Fig. 91 is a diagram illustrating transmission and
25 reception timings of a dedicated physical channel (during
DHO).

[Fig. 92]

Fig. 92 is a diagram illustrating a transmission pattern of perch channels.

[Fig. 93]

Fig. 93 is a diagram illustrating a transmission pattern of a forward common control channel (for FACH).

[Fig. 94]

Fig. 94 is a diagram illustrating a transmission pattern of a forward common control channel (for PCH).

[Fig. 95]

Fig. 95 is a diagram illustrating a transmission pattern of a reverse common control channel (for RACH).

[Fig. 96]

Fig. 96 is a diagram illustrating a transmission pattern of a dedicated physical channel (during high speed closed loop transmission power control).

[Fig. 97]

Fig. 97 is a flowchart illustrating a CPS PDU (content provider system protocol data unit) assembling method (other than RACH).

[Fig. 98]

Fig. 98 is a flowchart illustrating a CPS PDU assembling method (RACH).

[Name of Document] ABSTRACT

[Abstract]

[Problem to be Solved]

5 A base station apparatus in a mobile communication system which is best suited for high speed CDMA digital communications.

[Solving Means]

10 The base station apparatus has a transmission and reception amplifying section that amplifies a CDMA signal transmitted to or received from a mobile station, a radio section connected to the transmission and reception amplifying section to subject a baseband-spread transmitted signal to a D/A conversion and then to an orthogonal modulation and to subject a received signal to
15 a quasi-synchronous detection and then to an A/D convention, a baseband signal processing section connected to the radio section to execute baseband signal processing on the transmitted signal and the received signal, a transmission path interface connected to the baseband signal processing
20 section to interface an external channel, and a base station control section to control radio channel management, setting and releasing of radio channels and so on. Communication with the external channel is carried out using an ATM cell. Communication with the mobile
25 station using the CDMA signal is carried out by mapping a plurality of logical channels onto a plurality of physical channels. The CDMA signal is spread using two

types of spreading sequence codes including a short and long spreading sequence codes.

[Selected figure]

Fig. 1

09-116192

[Document Name] Correction Data Ex Offico

[Document Corrected] Patent Application

<Information Acknowledged · Information Added>

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[Identification Number] 392026693

[Address] 10-1, Toranomom 2-chome,
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[Appointed Agent]

[Identification Number] 100088915

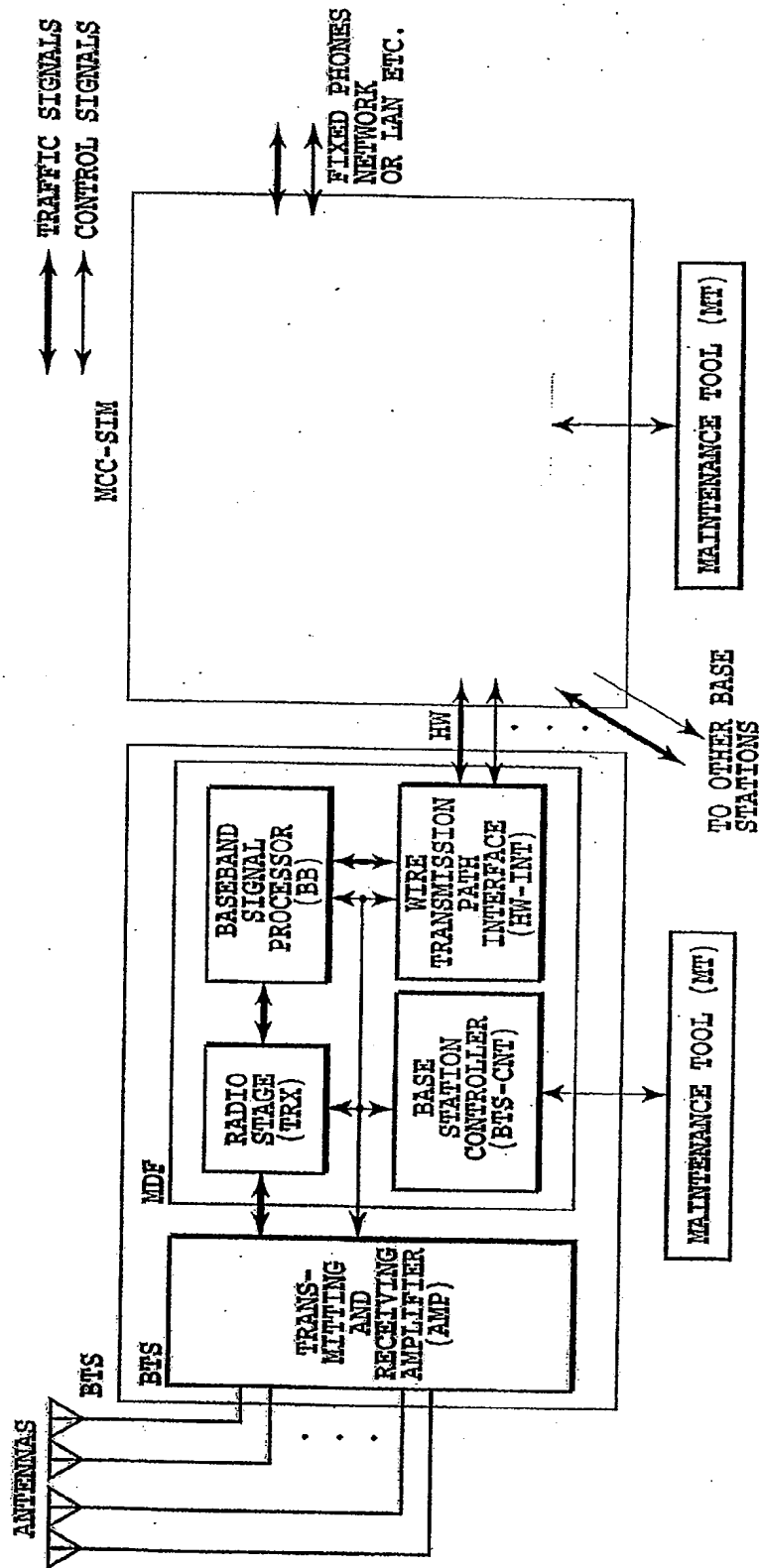
[Address] Suite 300, 6th Seiko Bldg. 1-31,
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[Name] Kazuo ABE

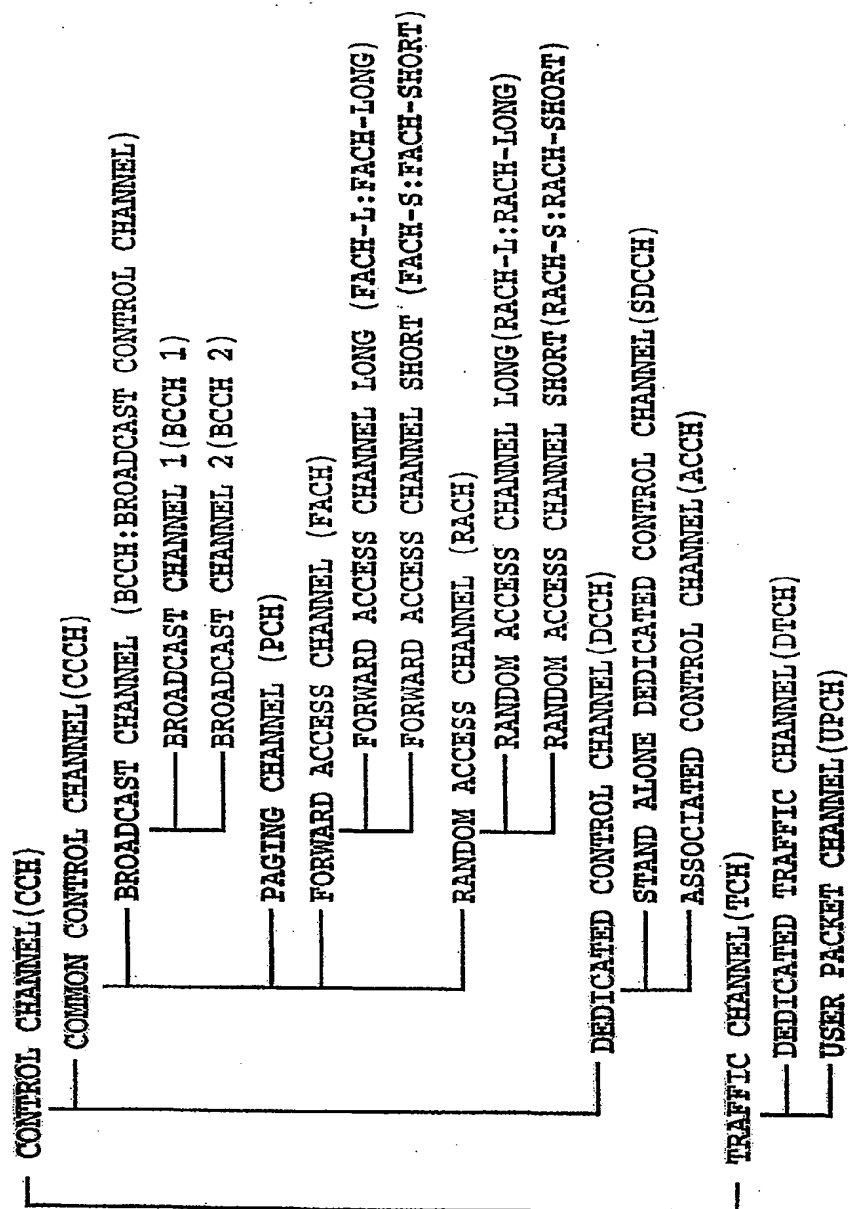
09-116192

(Name of Document)
(Fig. 1)

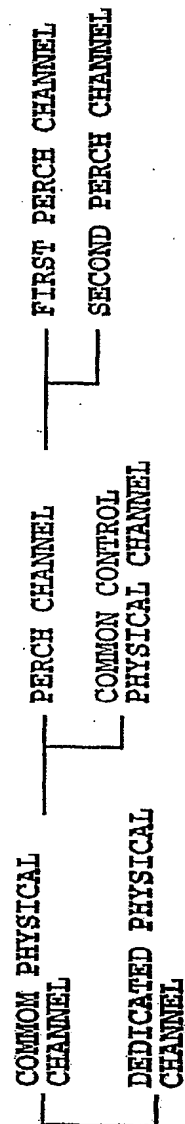
DRAWINGS



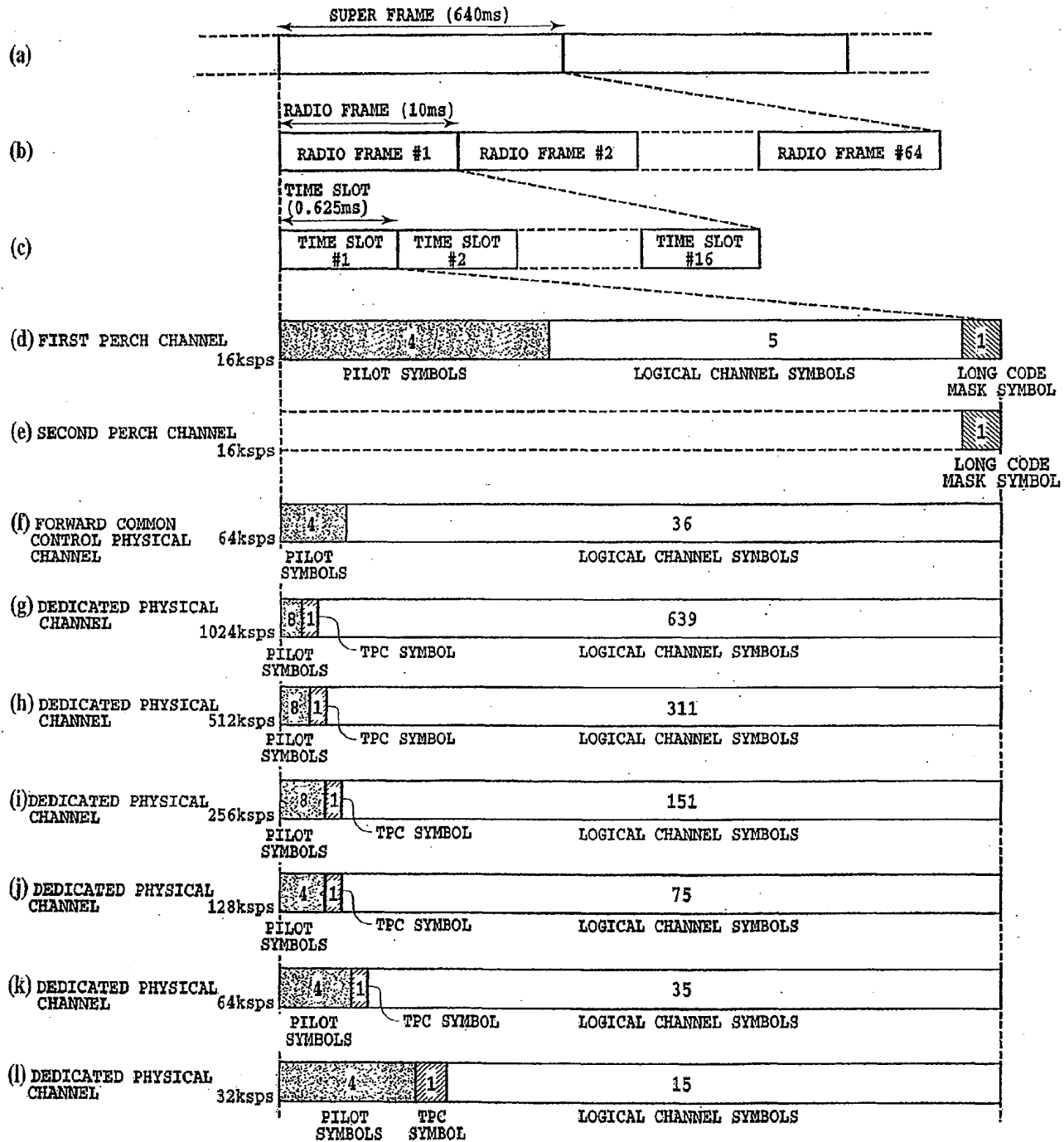
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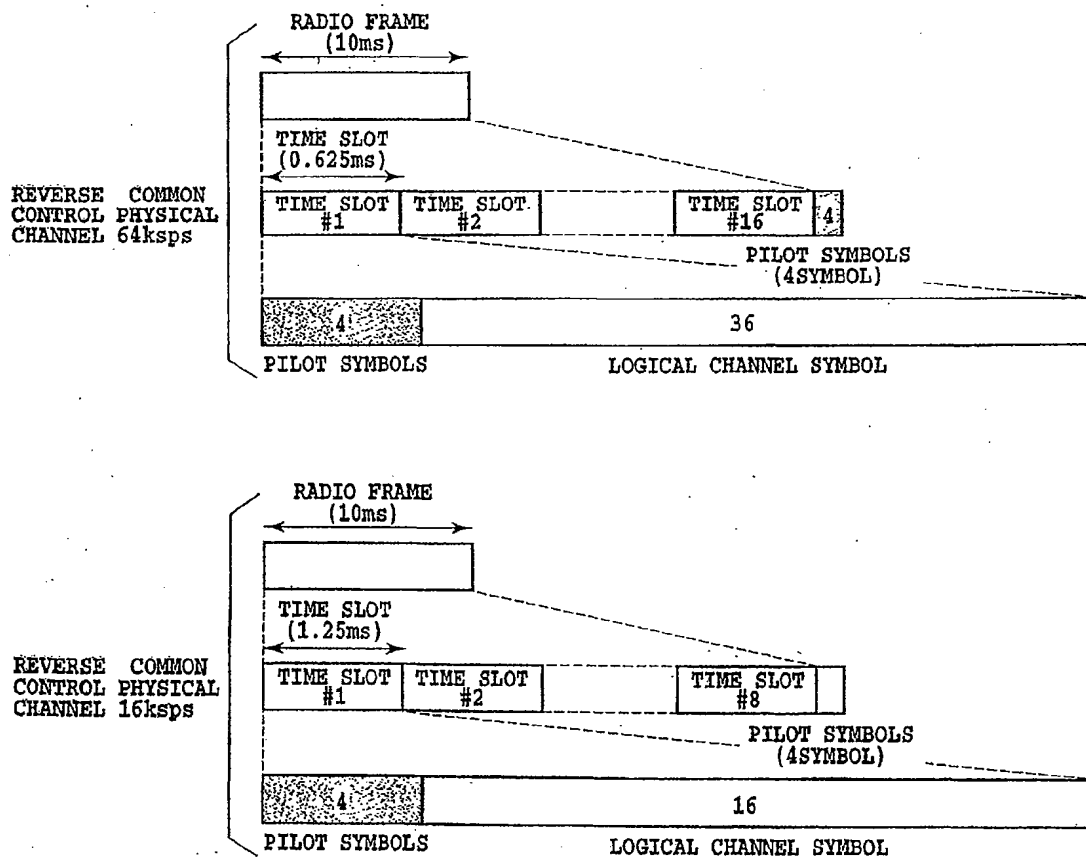
(Fig. 3)



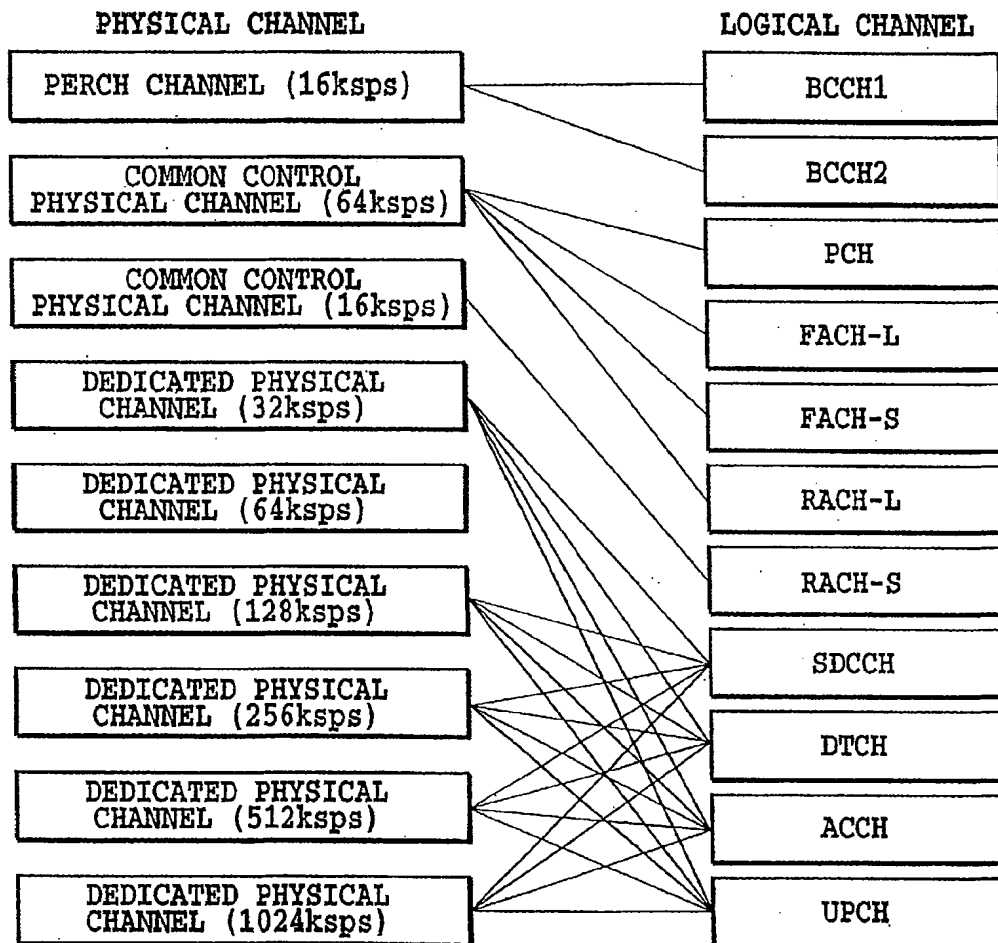
(Fig. 4)



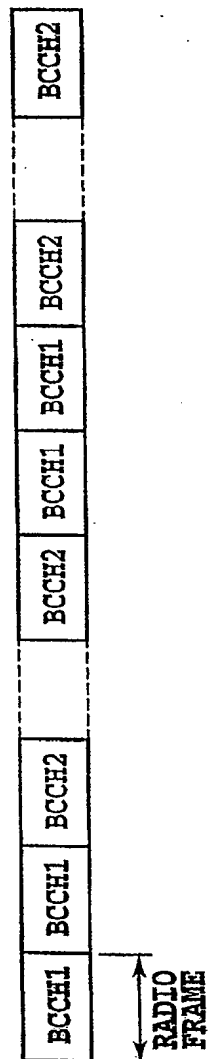
(Fig. 5)



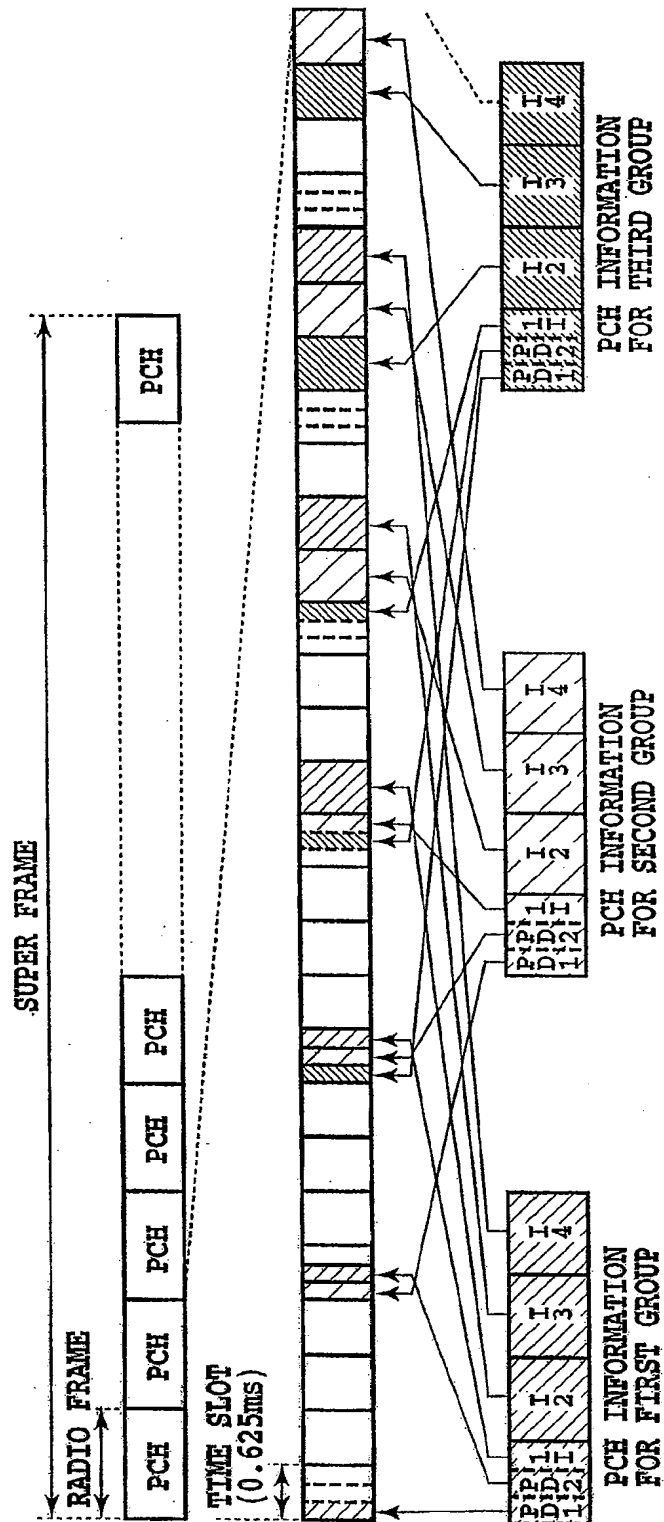
(Fig. 6)



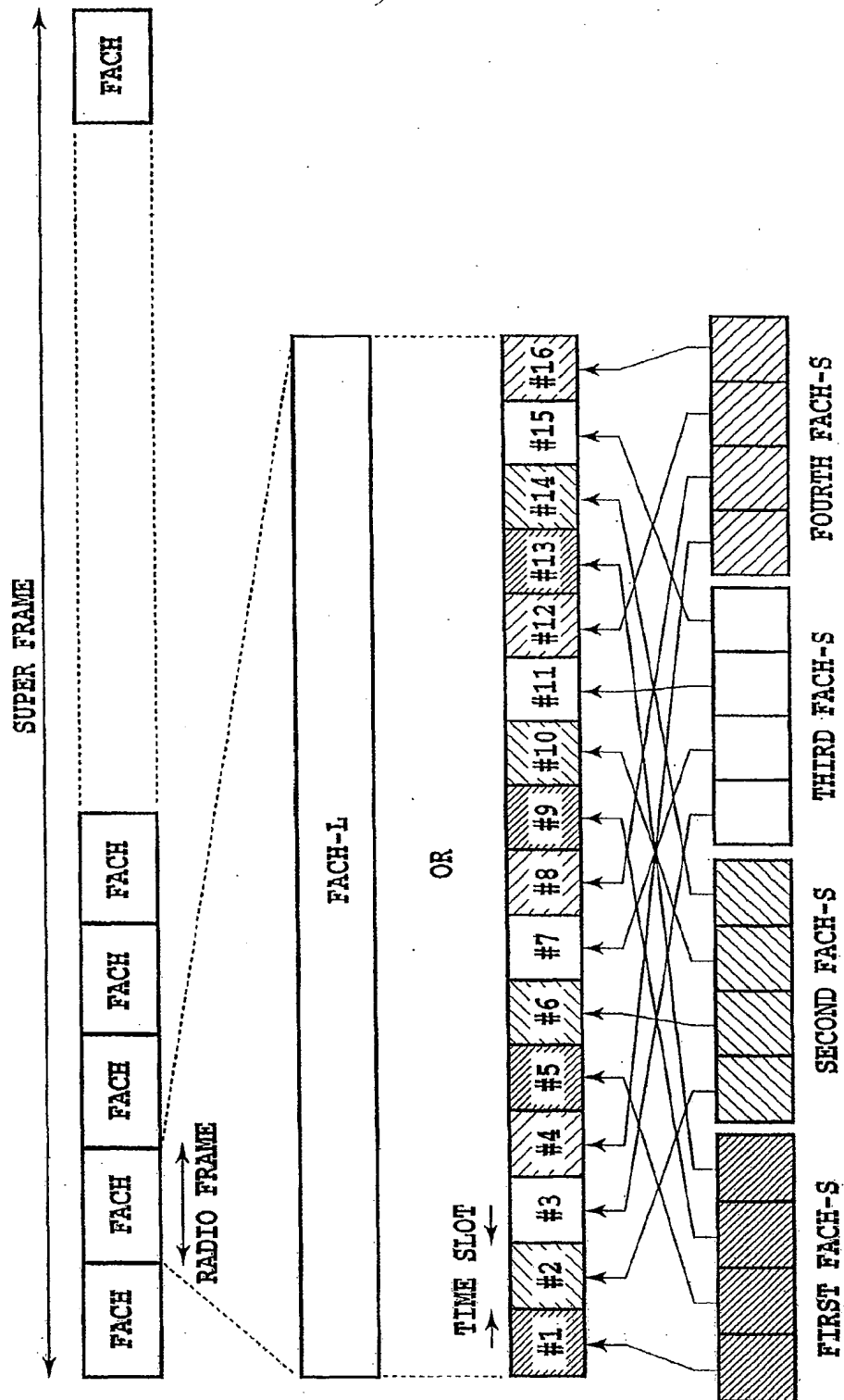
(Fig. 7)



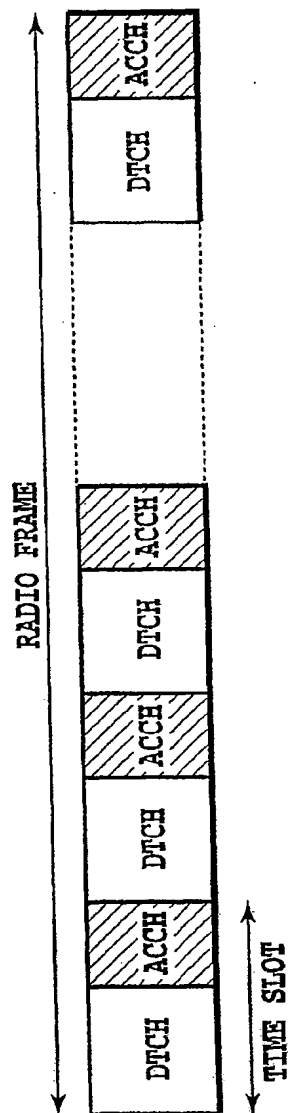
(Fig. 8)



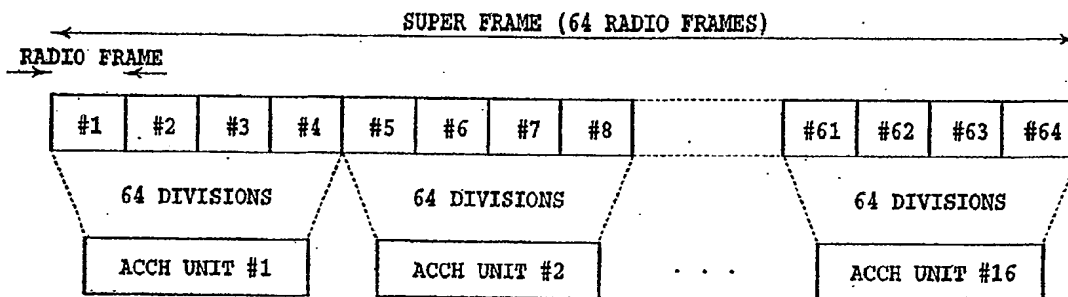
(Fig. 9)



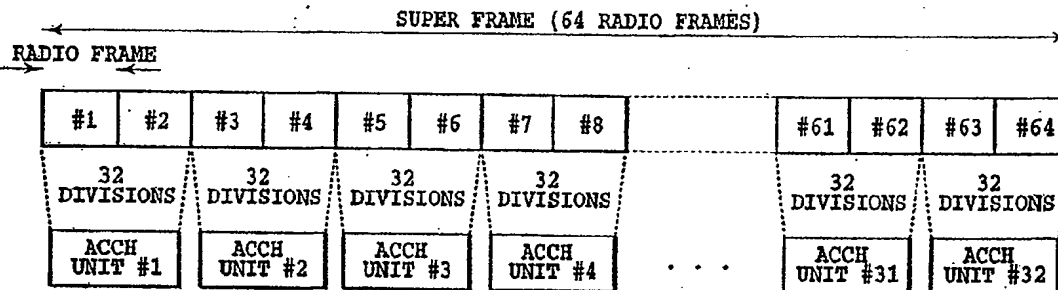
(Fig. 10)



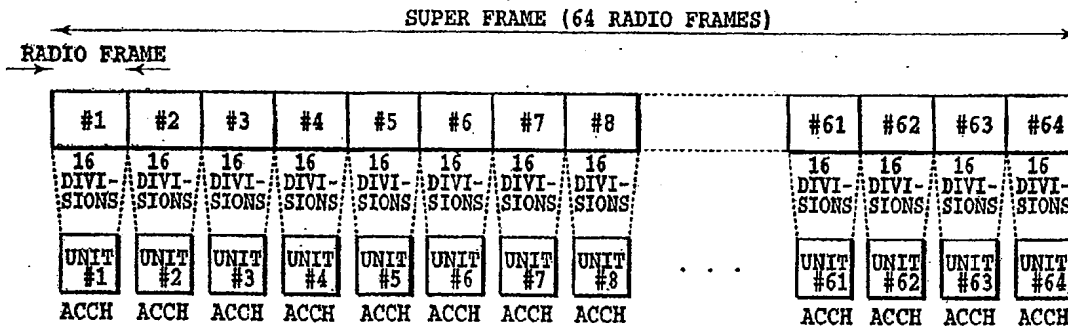
(Fig. 11)



(a) MAPPING INTO 32 OR 64kps DEDICATED PHYSICAL CHANNEL

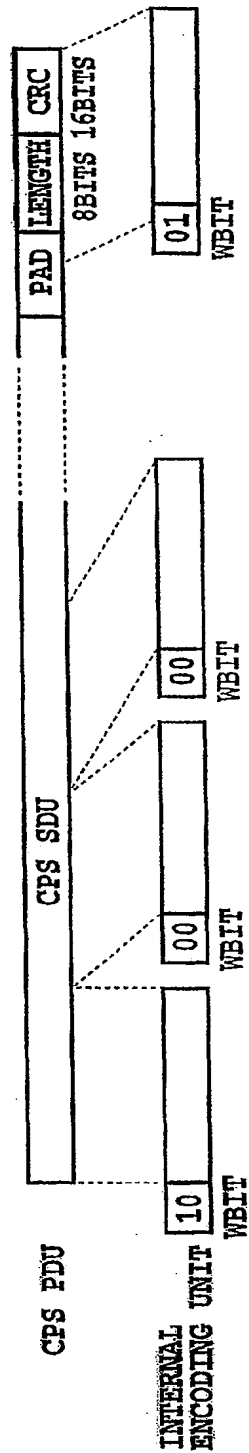


(b) MAPPING INTO 128kps DEDICATED PHYSICAL CHANNEL

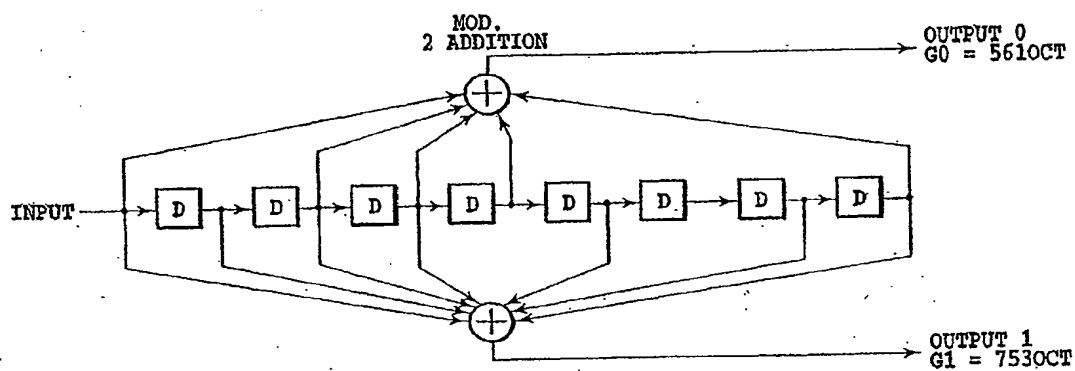
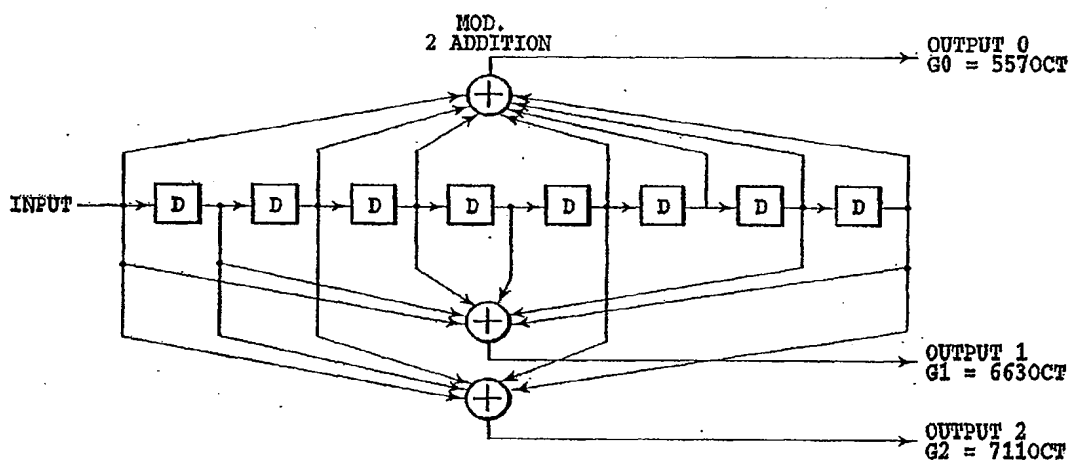


(c) MAPPING INTO 256kps DEDICATED PHYSICAL CHANNEL

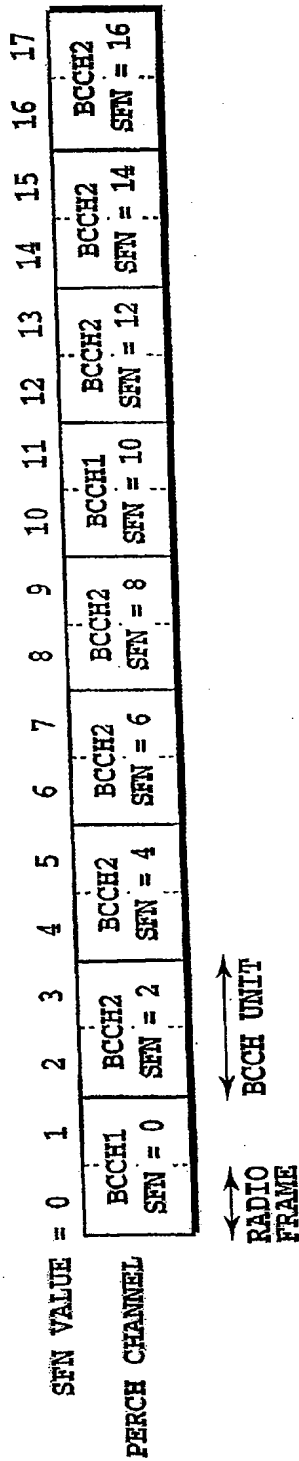
(Fig. 12)



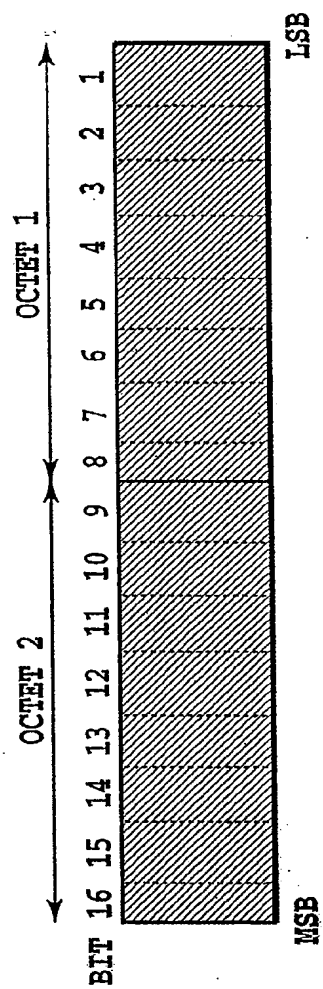
(Fig. 13)

(a) ENCODING RATE = $1/2$ CONSTRAINT LENGTH = 9(b) ENCODING RATE = $1/3$ CONSTRAINT LENGTH = 9

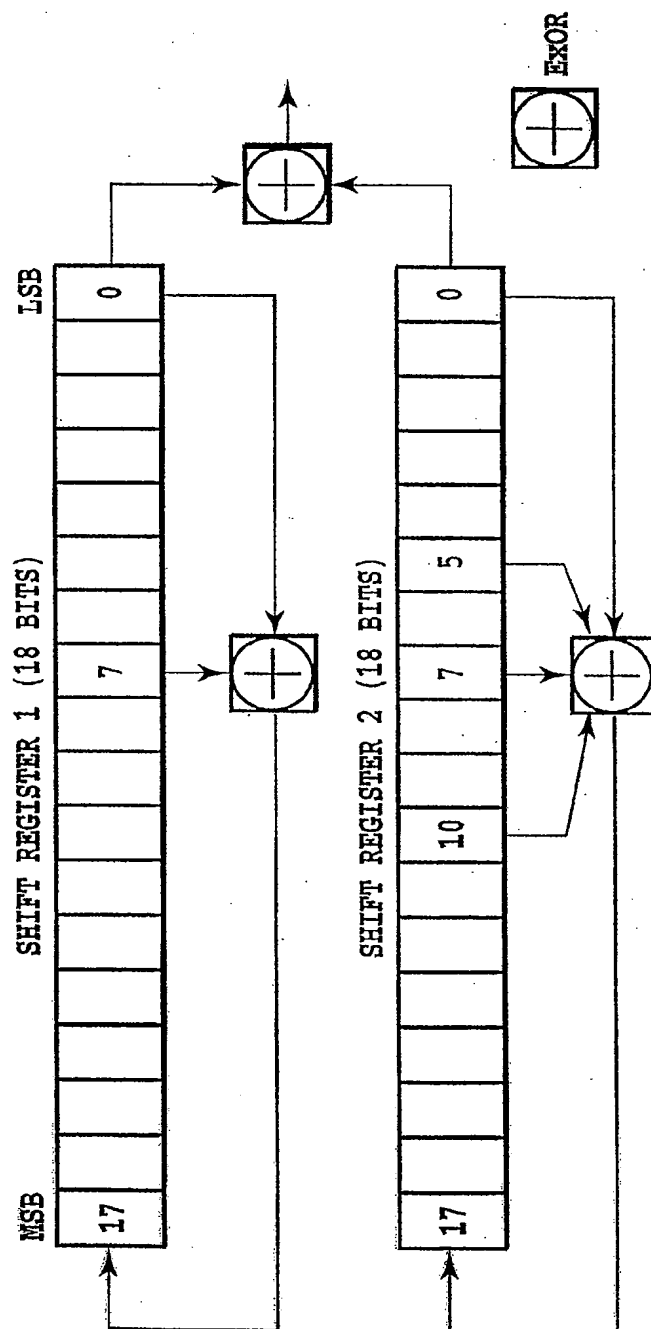
(Fig. 14)



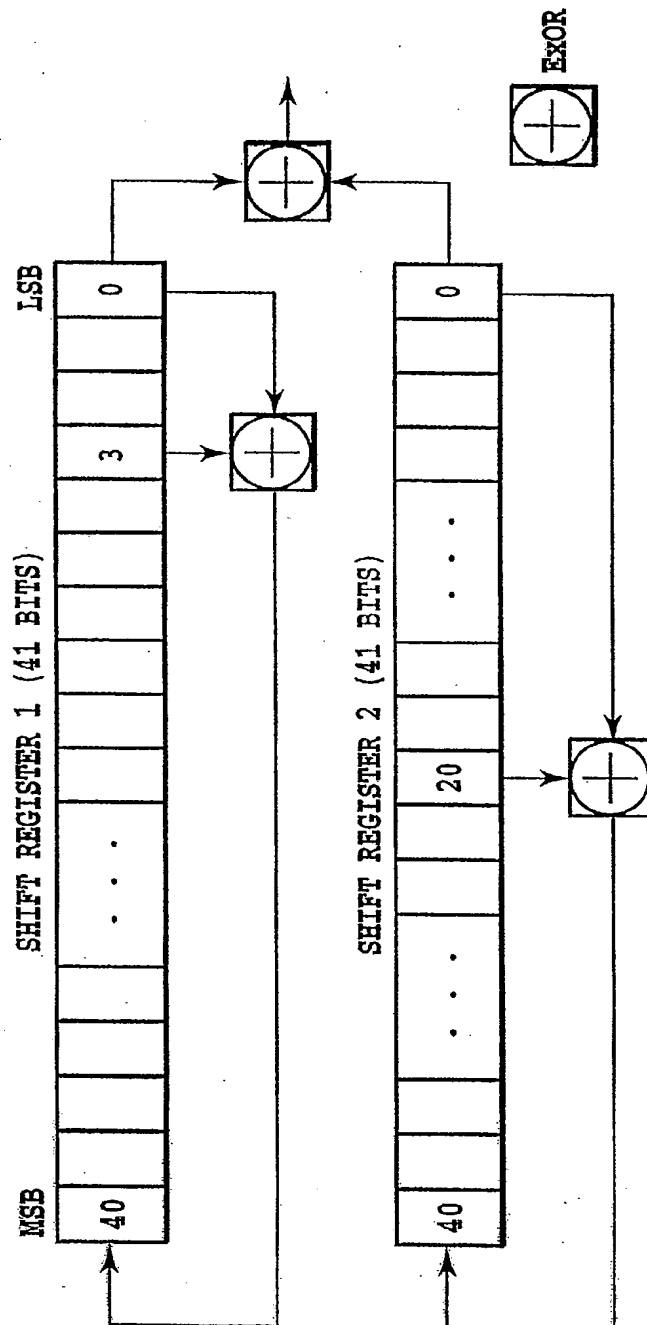
(Fig. 15)



(Fig. 16)



(Fig. 17)



(Fig. 18)

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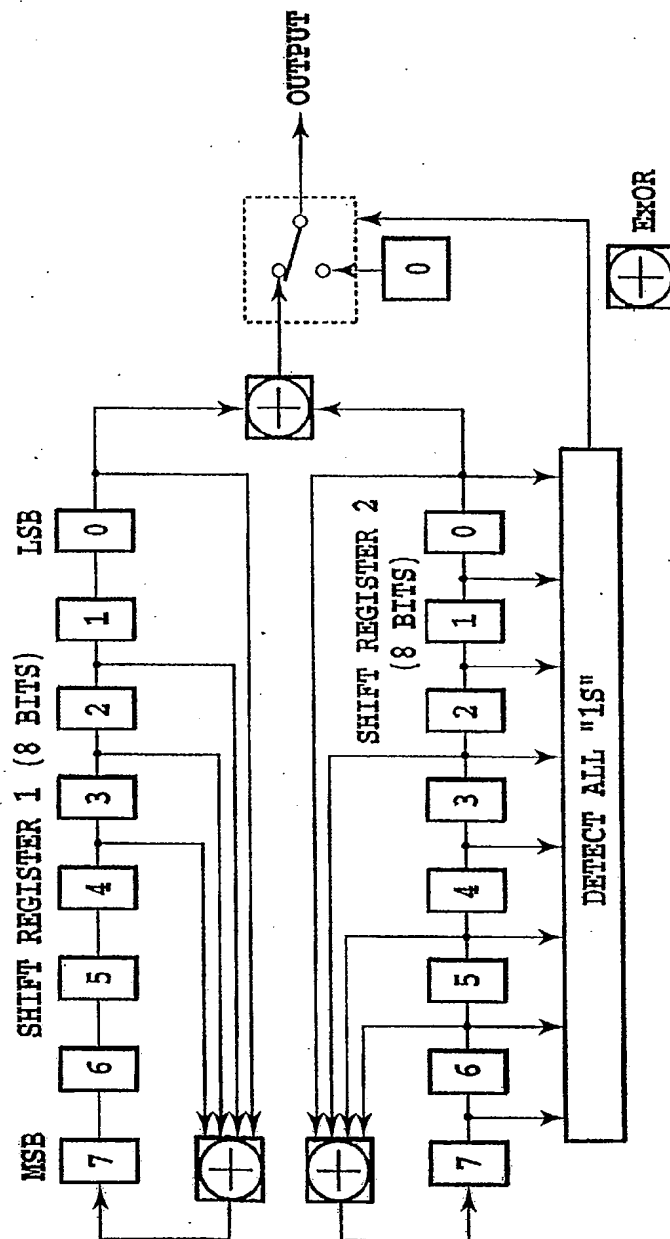
$$\begin{bmatrix} c_1(0) \\ c_1(1) \end{bmatrix} = \begin{bmatrix} c_0(0) & c_0(0) \\ c_0(0) & \overline{c_0(0)} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

$$\begin{bmatrix} c_2(0) \\ c_2(1) \\ c_2(2) \\ c_2(3) \end{bmatrix} = \begin{bmatrix} c_1(0) & c_1(0) \\ c_1(0) & \overline{c_1(0)} \\ c_1(1) & c_1(1) \\ c_1(1) & \overline{c_1(1)} \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$$

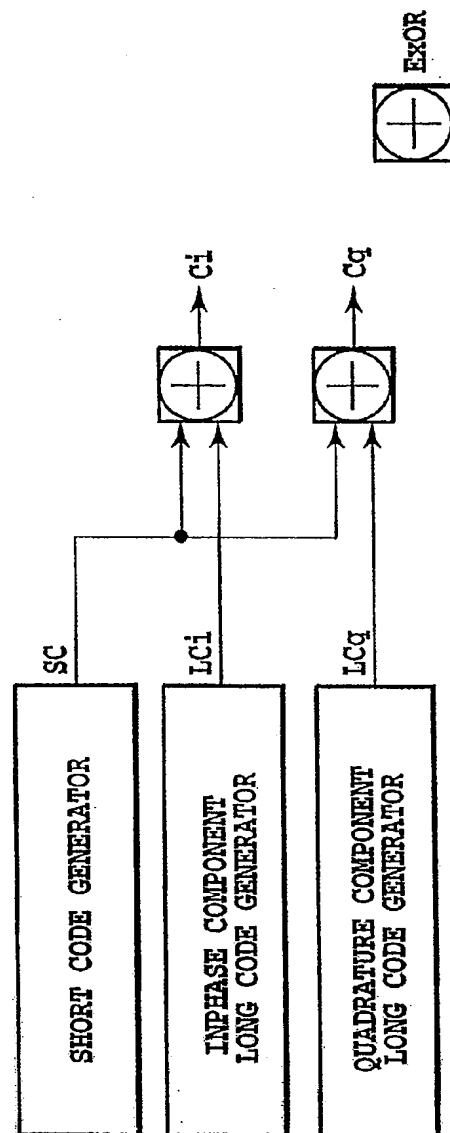
$$\vdots$$

$$\begin{bmatrix} c_{n+1}(0) \\ c_{n+1}(1) \\ c_{n+1}(2) \\ c_{n+1}(3) \\ \vdots \\ c_{n+1}(2^{n+1}-2) \\ c_{n+1}(2^{n+1}-1) \end{bmatrix} = \begin{bmatrix} c_n(0) & c_n(0) \\ c_n(0) & \overline{c_n(0)} \\ c_n(1) & c_n(1) \\ c_n(1) & \overline{c_n(1)} \\ \vdots & \vdots \\ c_n(2^{n-1}) & c_n(2^{n-1}) \\ c_n(2^{n-1}) & \overline{c_n(2^{n-1})} \end{bmatrix}$$

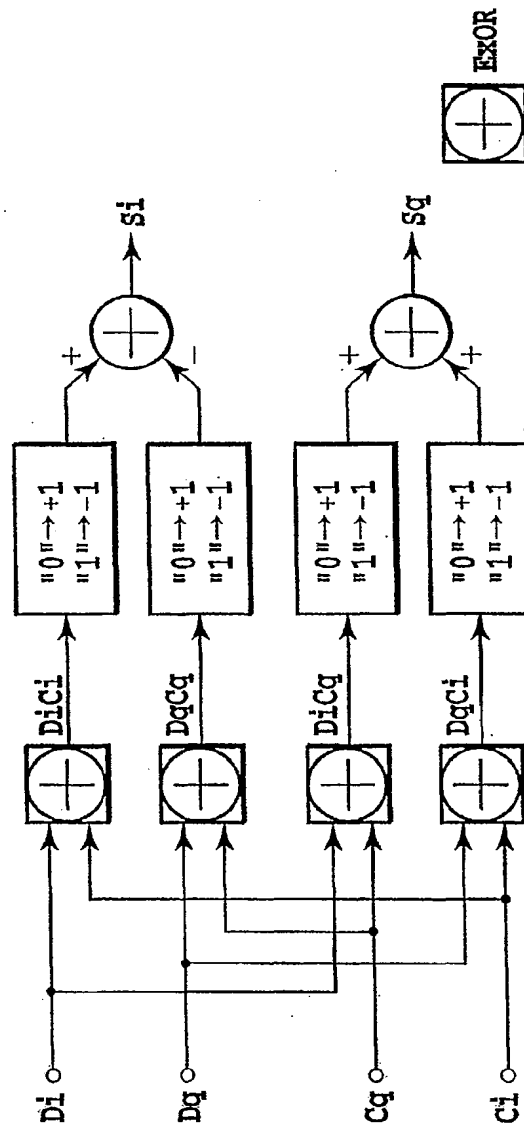
(Fig. 19)



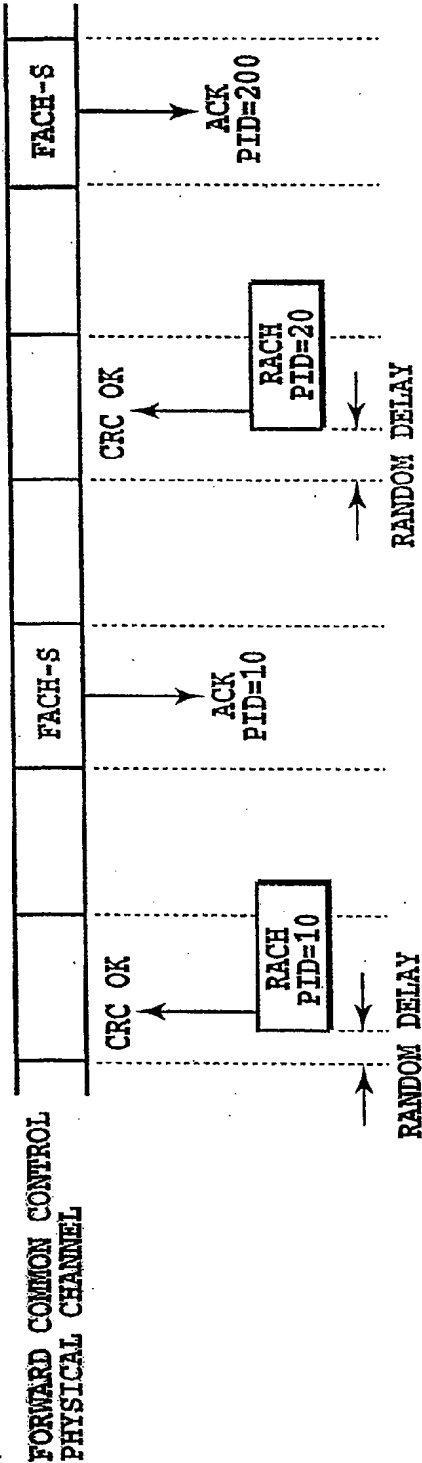
(Fig. 20)



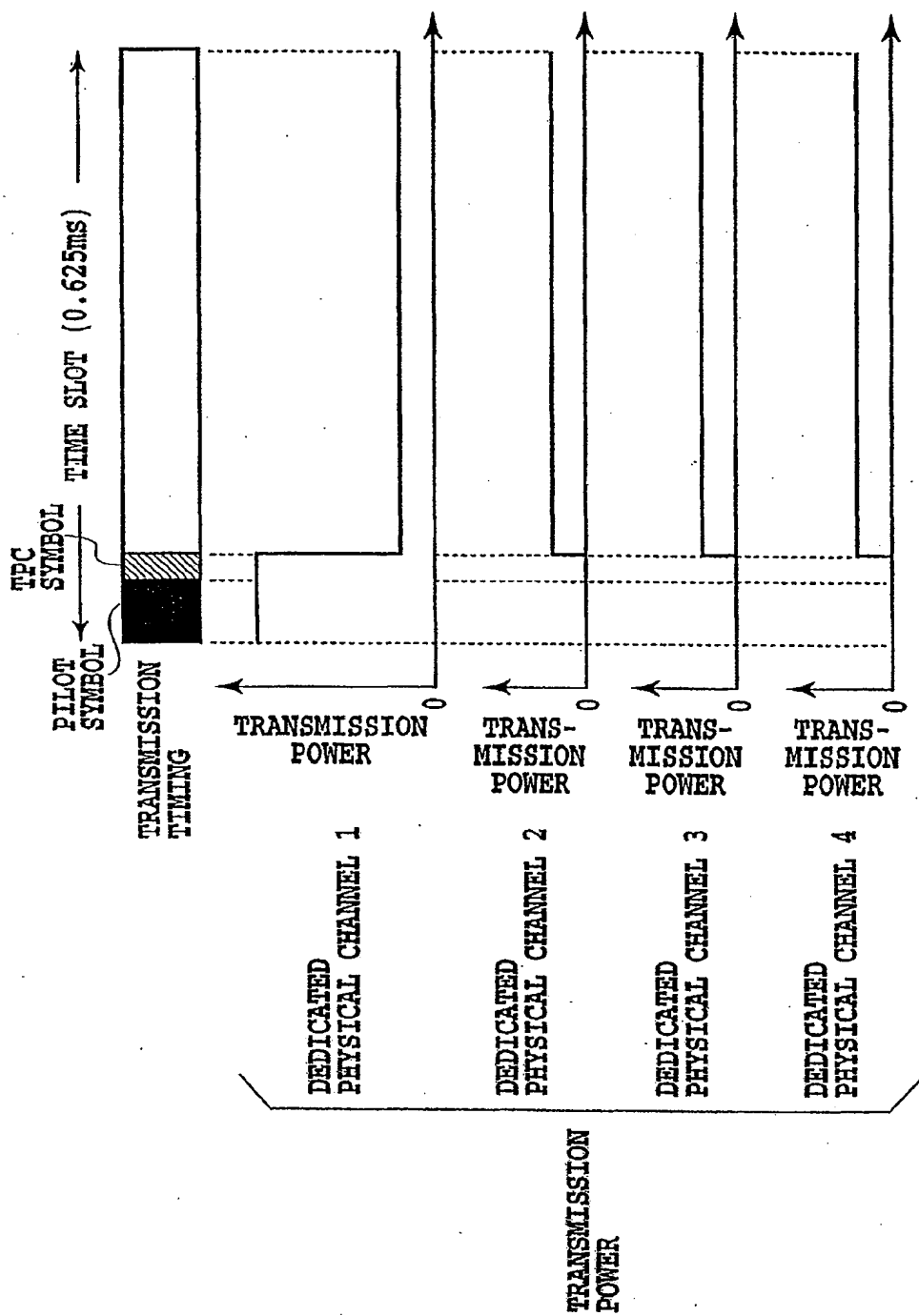
(Fig. 21)



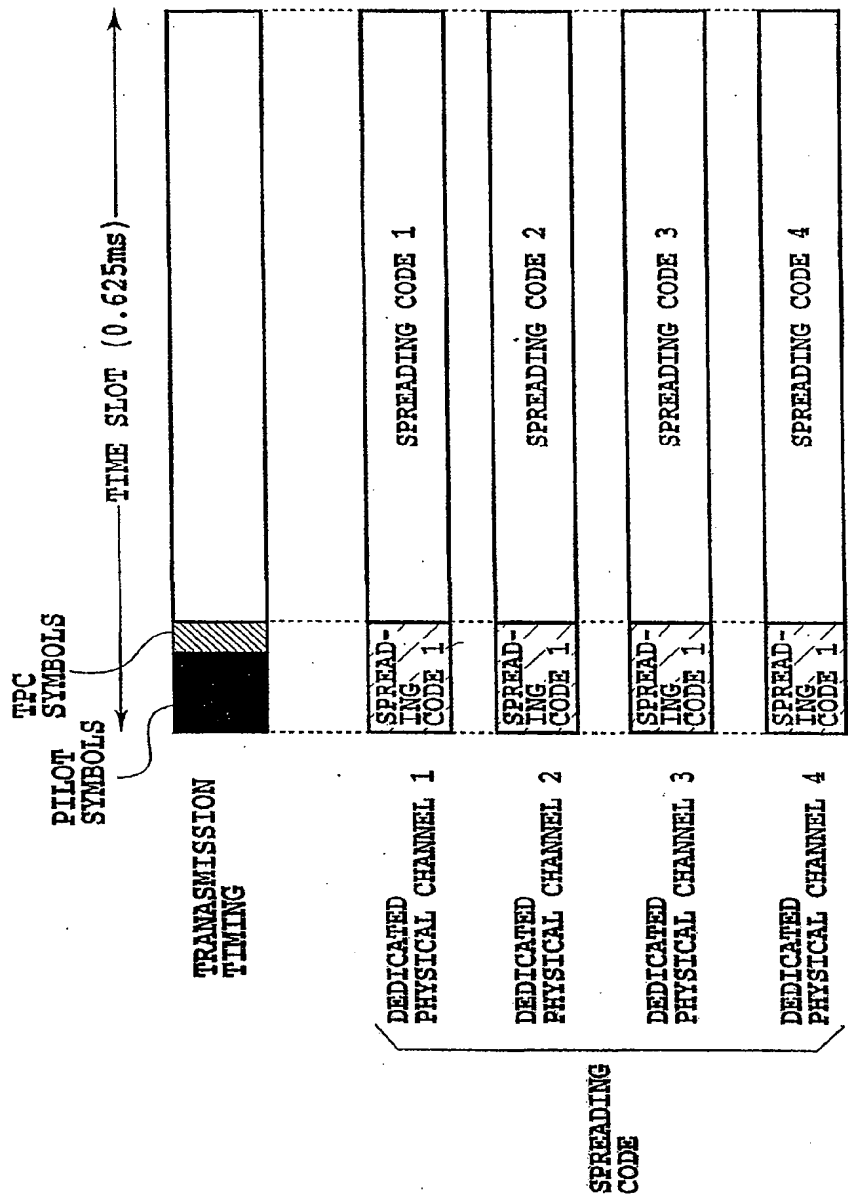
(Fig. 22)



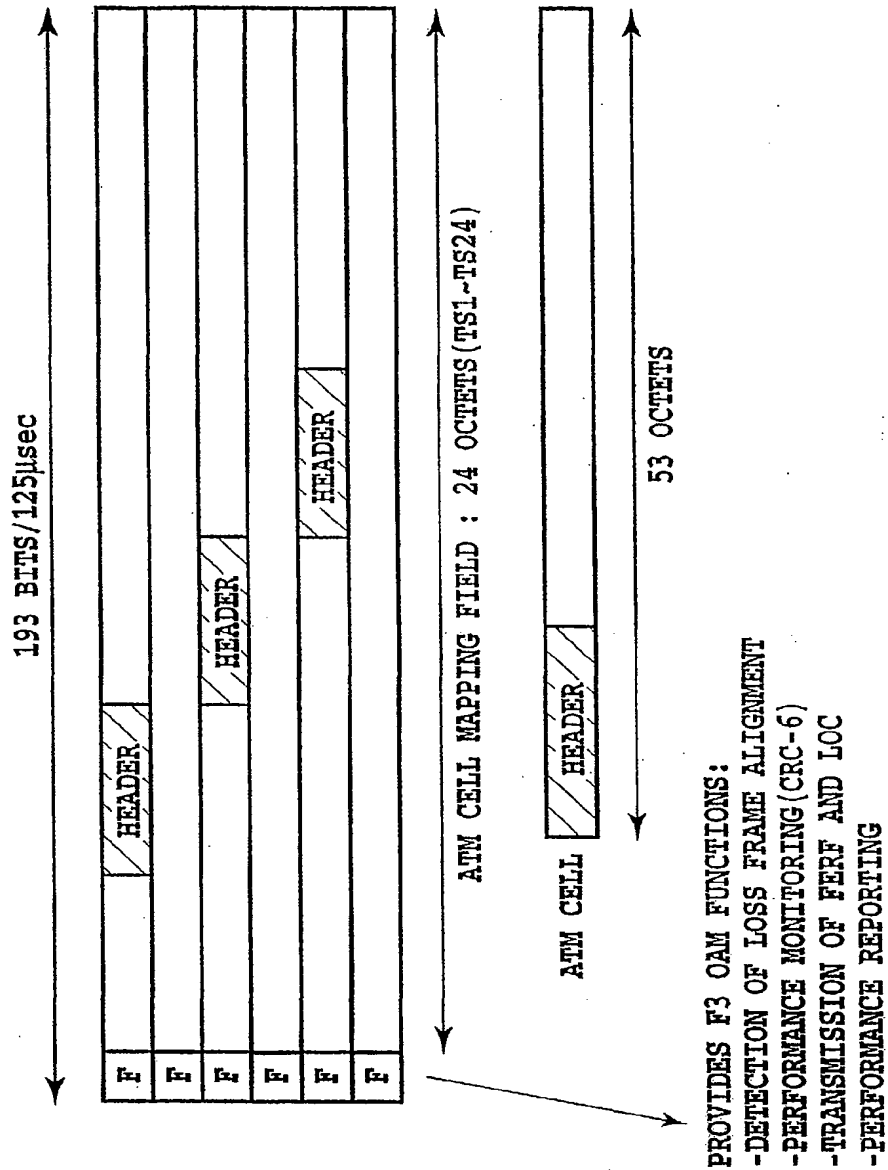
(Fig. 23)



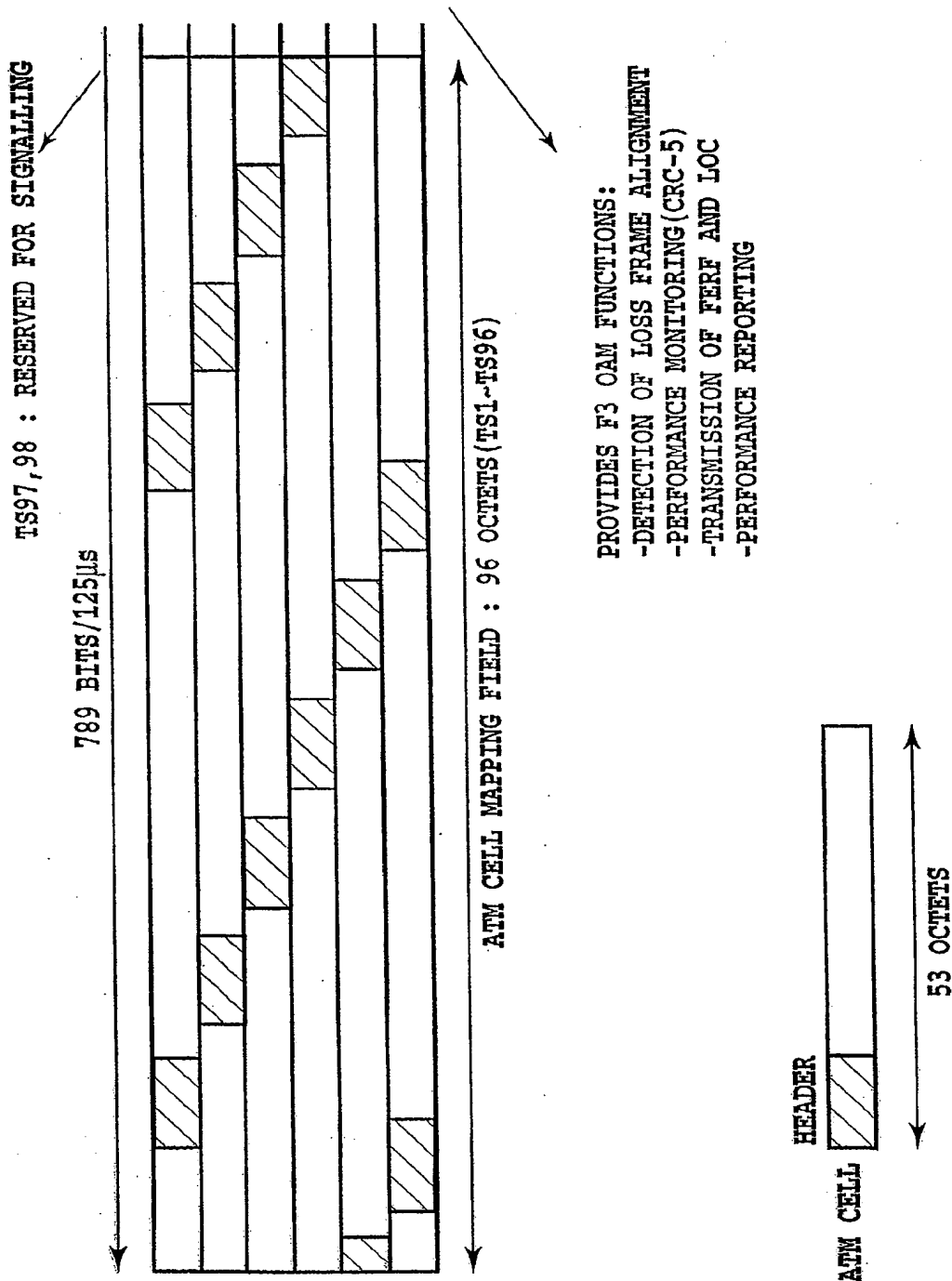
(Fig. 24)



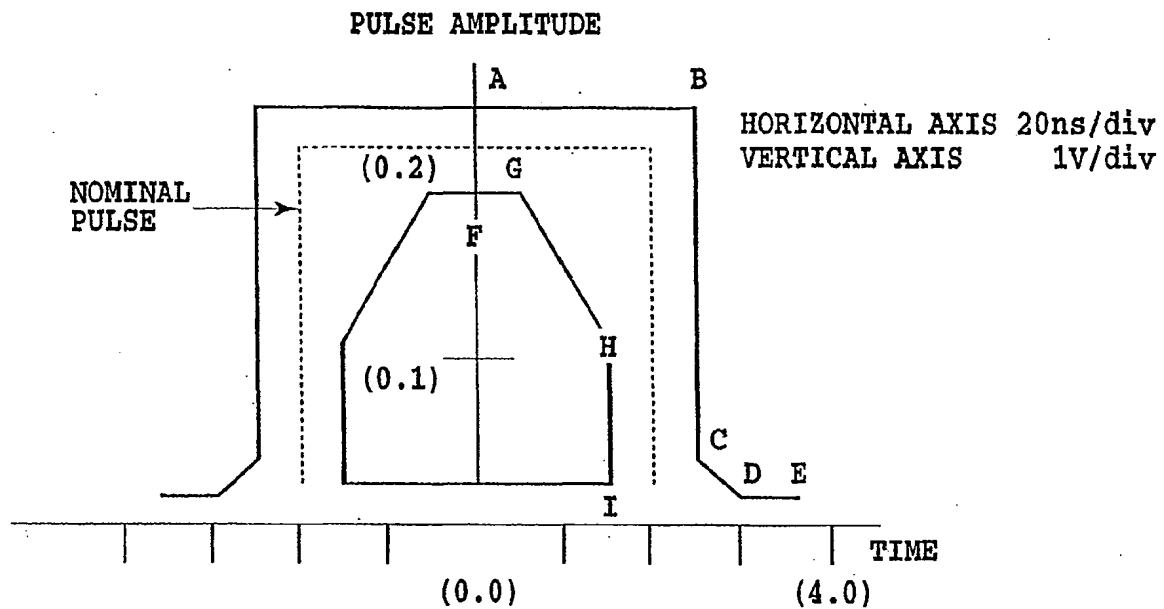
(Fig. 25)



(Fig. 26)



(Fig. 27)



**COORDINATES OF
INTERSECTION POINTS**

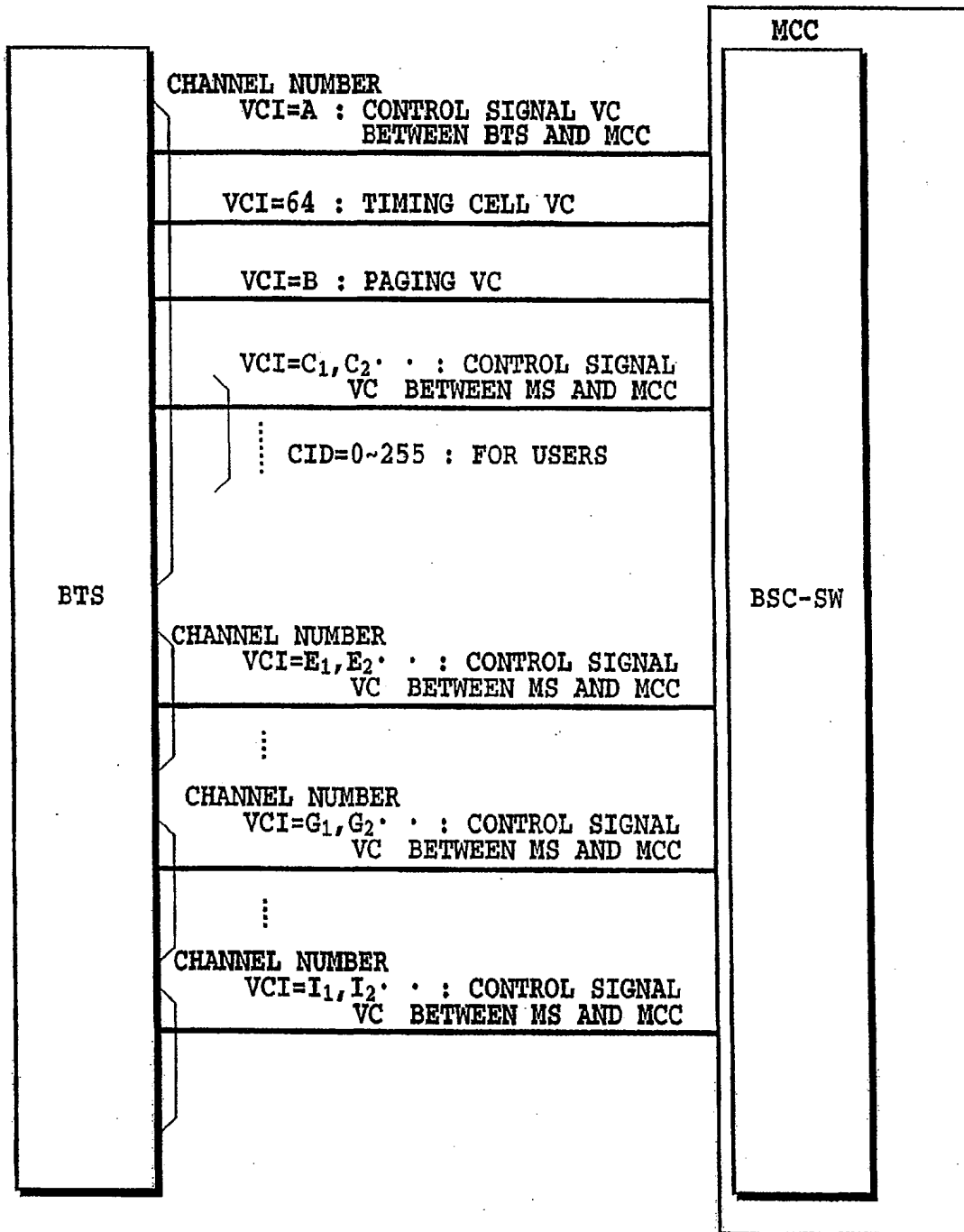
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C : (2.4, 1.0)	H : (1.6, 0.9)
D : (3.2, 0.3)	I : (1.6, 0.3)
E : (4.0, 0.3)	

Case Number:DCMH090007

(Fig. 28)

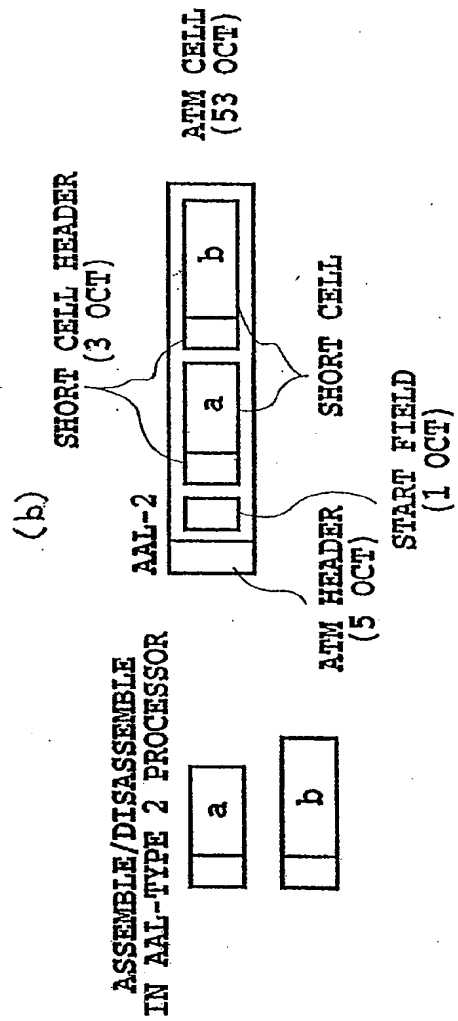
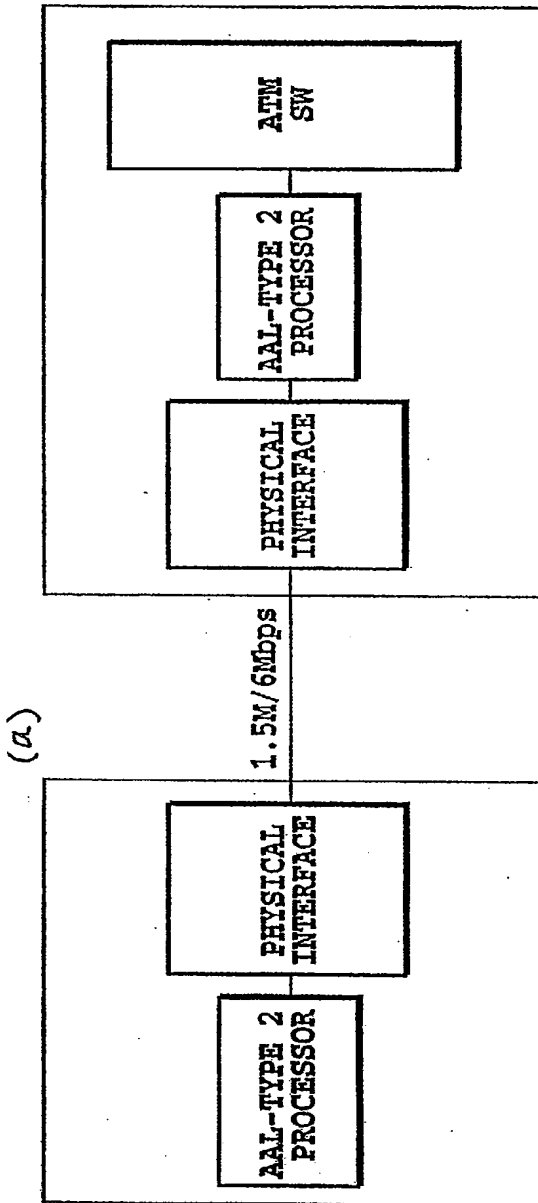
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OCT	2	00H		
OCT	3	00H		
OCT	4	01H		
OCT	5	52H		
OCT	6	6AH		
OCT	1	6AH		

(Fig. 29)



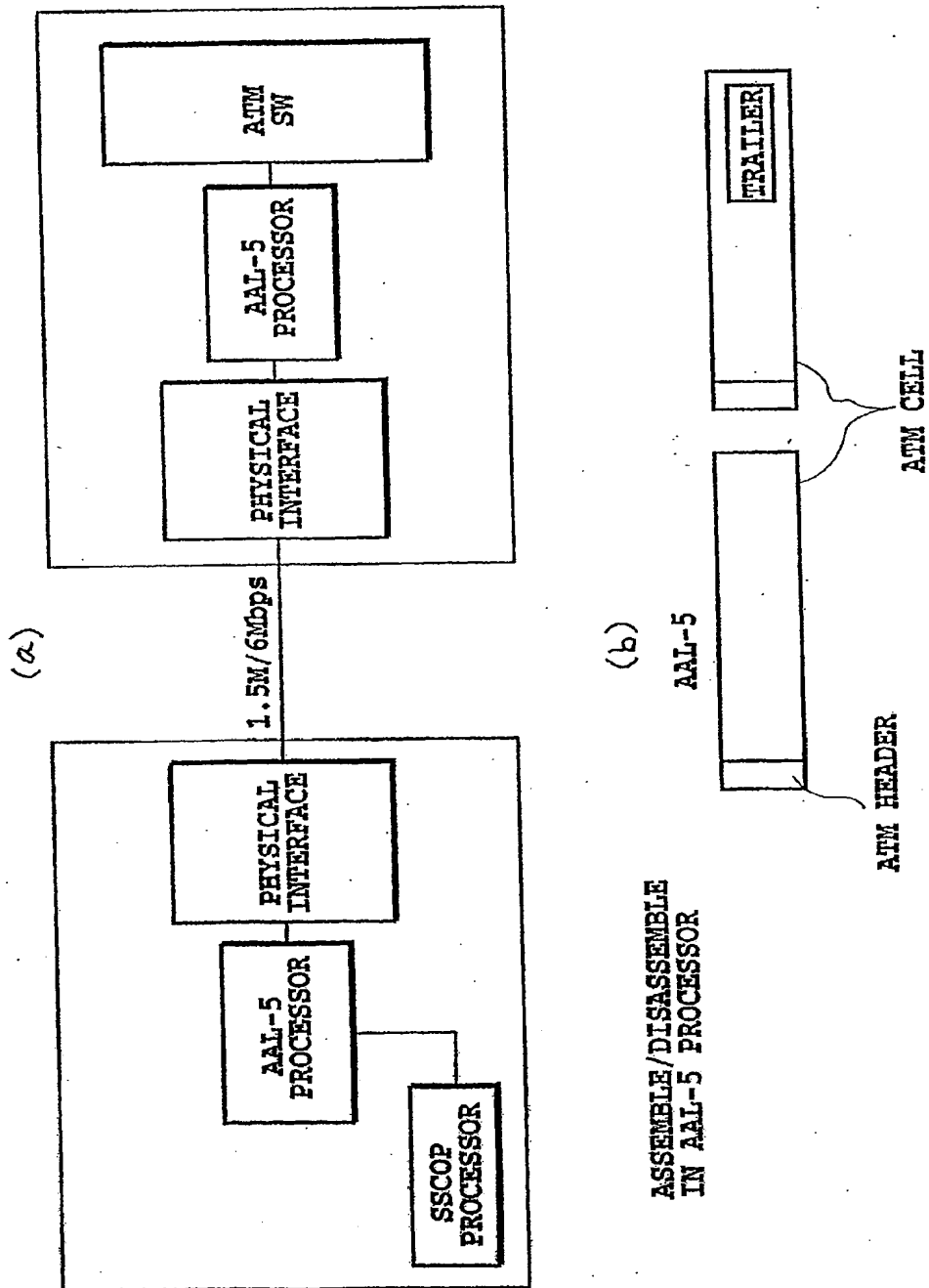
Case Number:DCMH090007

(Fig. 30)



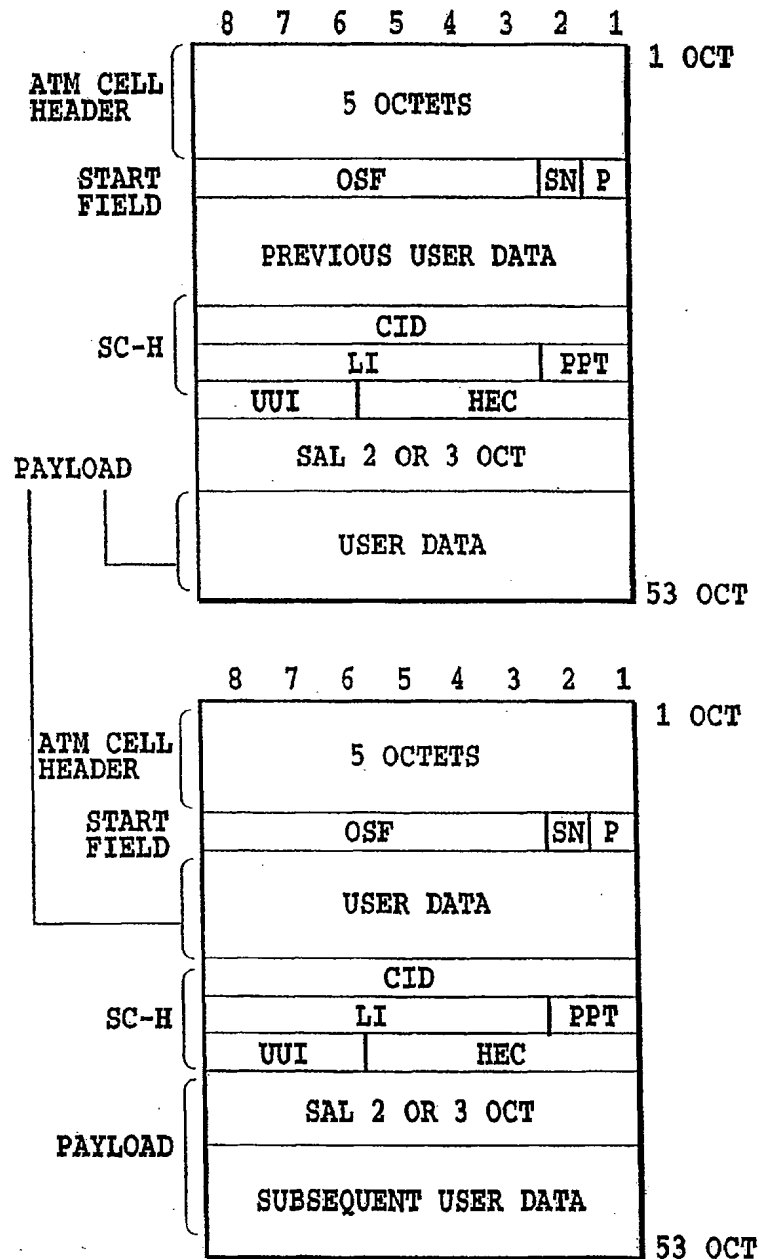
Case Number:DCMH090007

(Fig. 31)



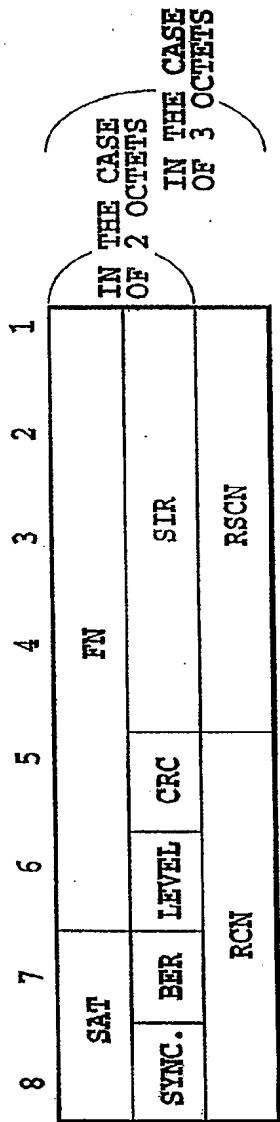
Case Number:DCMH090007

(Fig. 32)

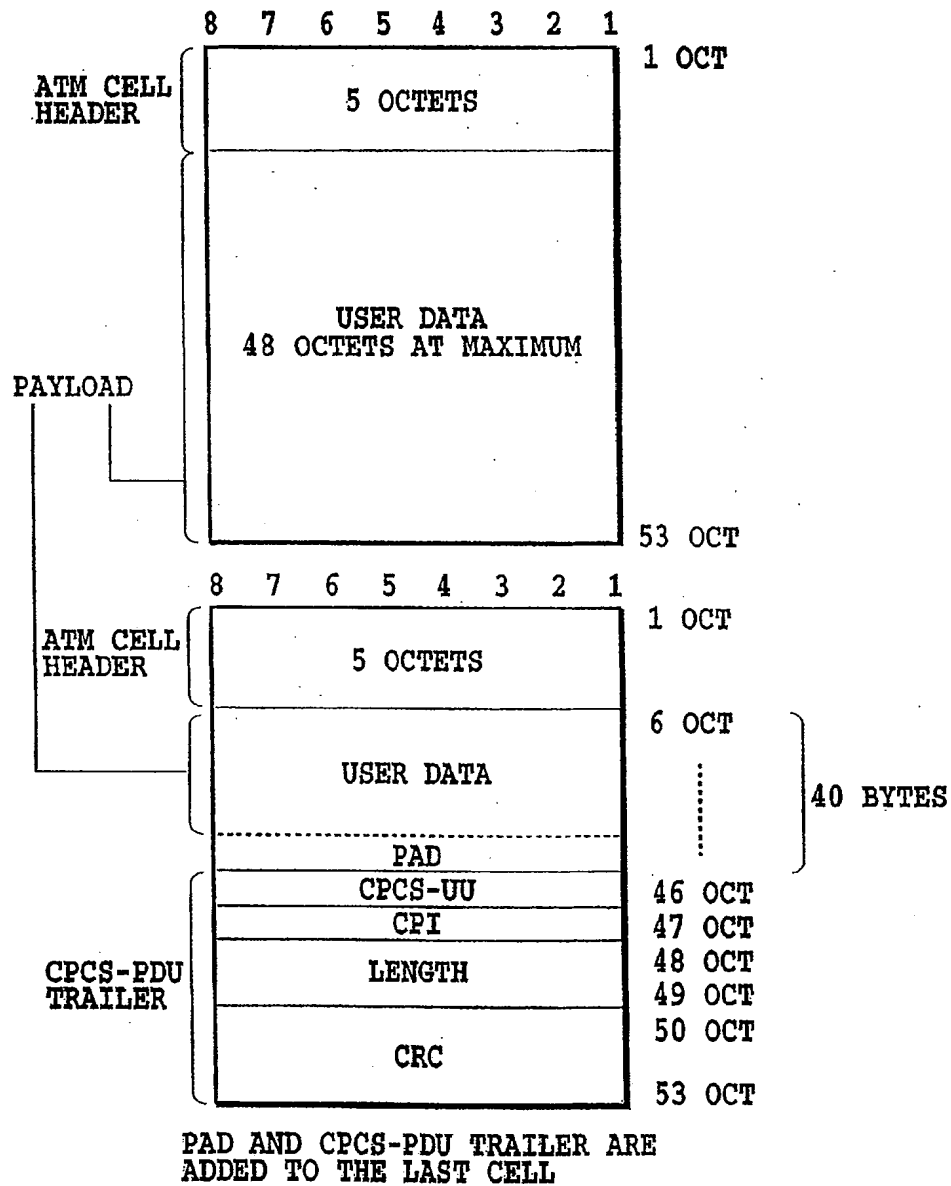


- START FIELD (1 OCTET)
- OSF:OFFSET FIELD

(Fig. 33)



(Fig. 34)



Case Number:DCMH090007

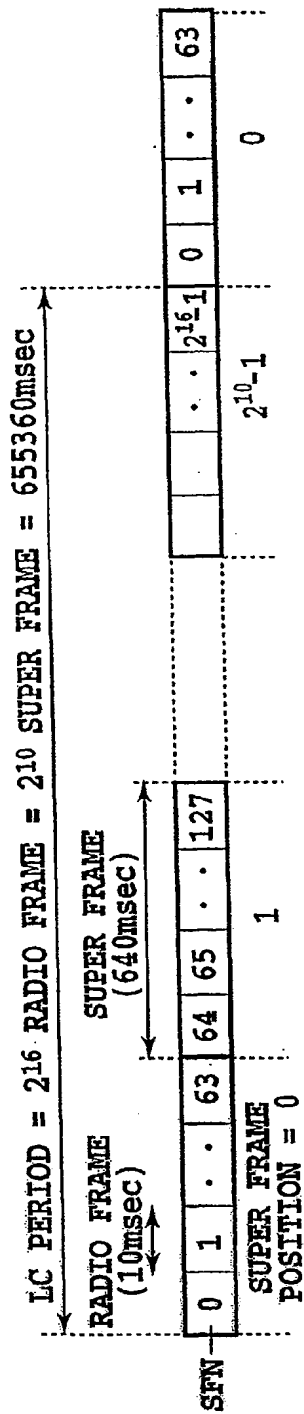
(Fig. 35)

VPI
VCI
PTI
CLP
HEC
MESSAGE ID
NUMBER OF TIMES OF CORRECTIONS (1 OCTET)
CORRECTION RANGE (1 OCTET)
TRANSMISSION DELAY (2 OCTET)
SF TIME INFORMATION (RECEPTION) (MASTER SIDE) (2 OCTETS)
SF TIME INFORMATION (TRANSMISSION) (MASTER SIDE) (2 OCTETS)
SF TIME INFORMATION (RECEPTION) (SLAVE SIDE) (2 OCTETS)
SF TIME INFORMATION (TRANSMISSION) (SLAVE SIDE) (2 OCTETS)
SF PHASE SHIFT VALUE (2 OCTETS)
LC COUNTER INFORMATION (RECEPTION) (MASTER SIDE) (3 OCTETS)
LC COUNTER INFORMATION (TRANSMISSION) (MASTER SIDE) (3 OCTETS)
LC COUNTER INFORMATION (RECEPTION) (SLAVE SIDE) (3 OCTETS)
LC COUNTER INFORMATION (TRANSMISSION) (SLAVE SIDE) (3 OCTETS)
LC COUNTER SHIFT VALUE (3 OCTETS)
UNUSED (6A (h))
000000
CRC-10

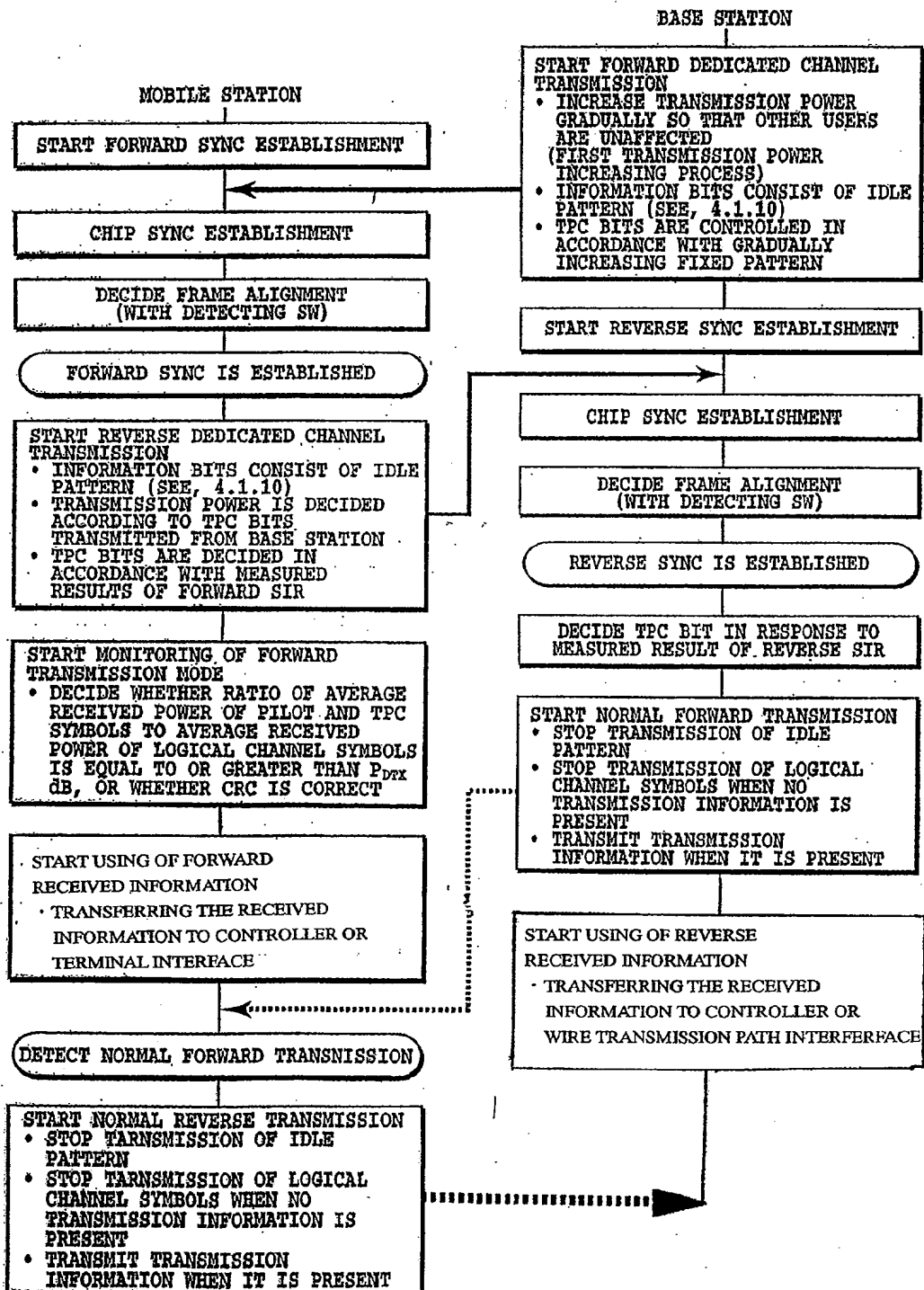
ATM HEADER

Case Number:DCMH090007

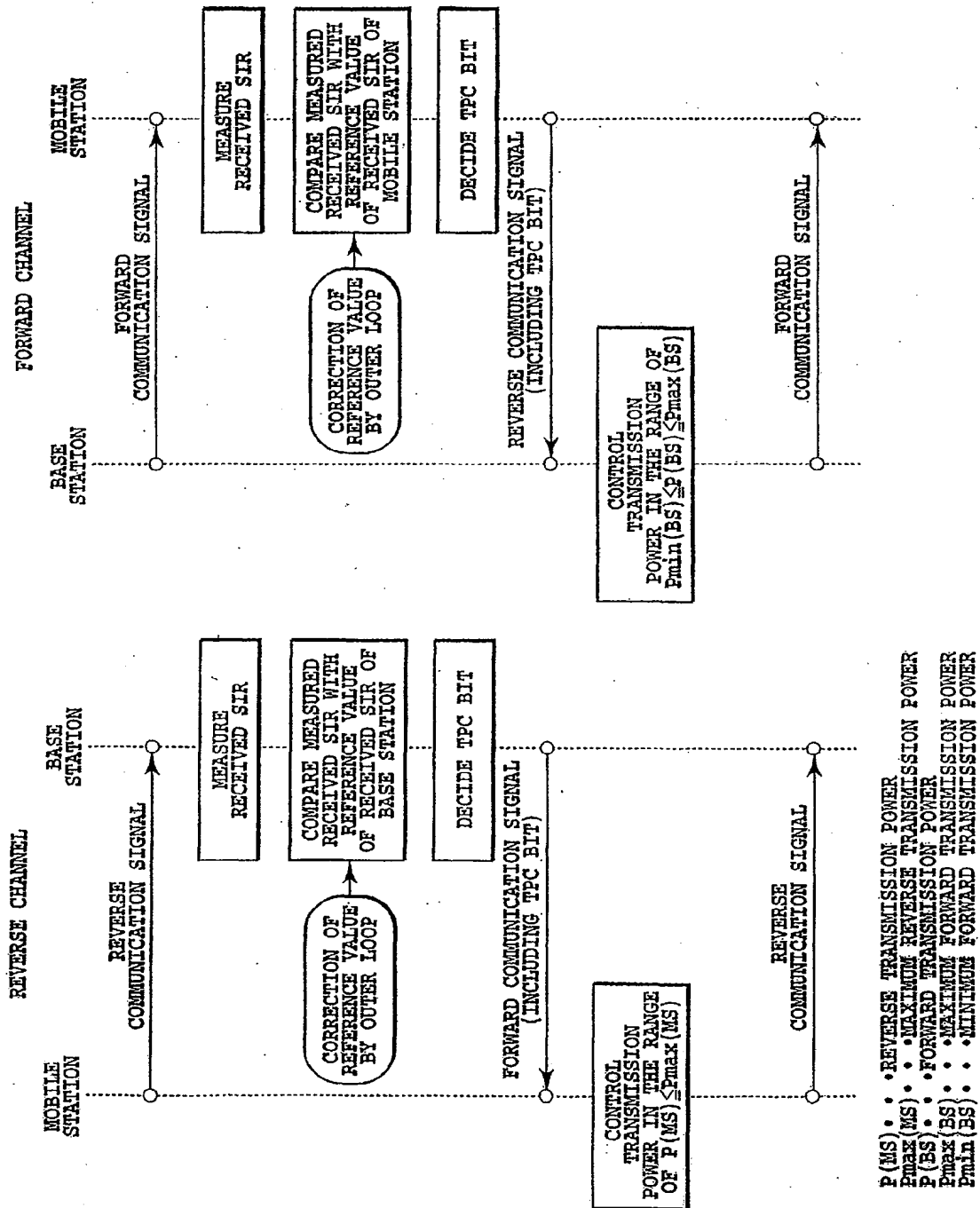
(Fig. 36)



(Fig. 37)

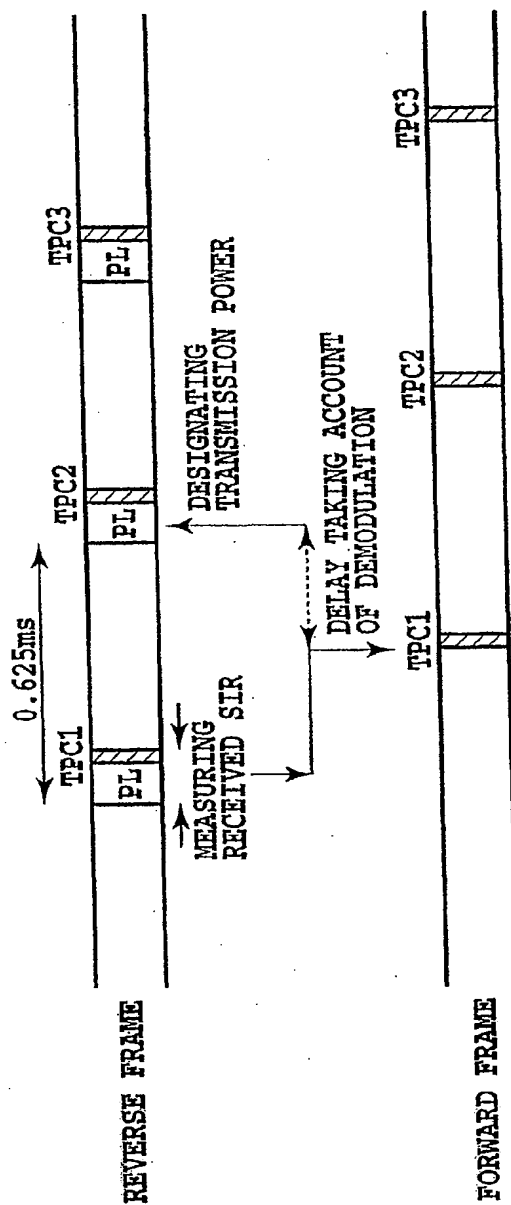


(Fig. 38)



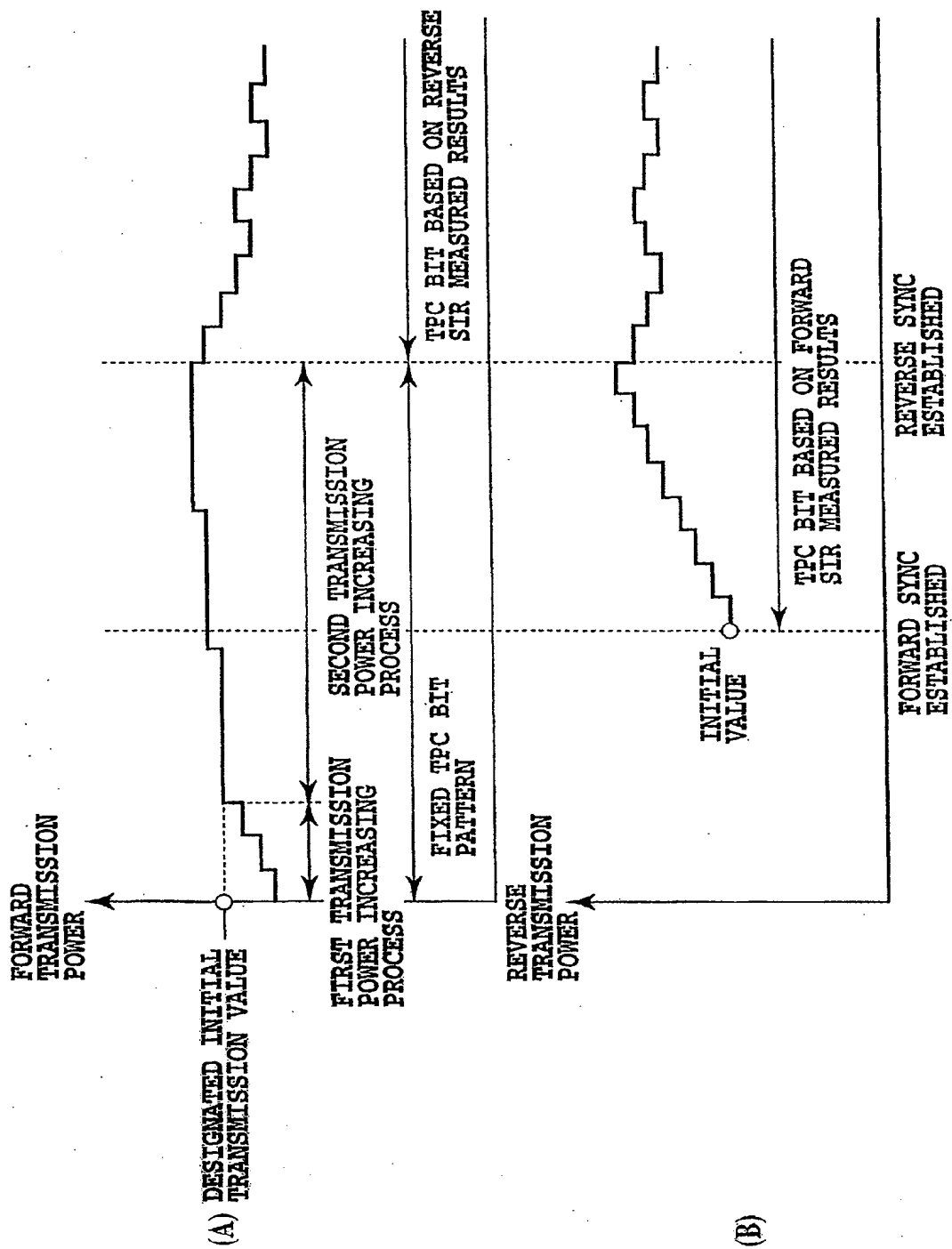
Case Number:DCMH090007

(Fig. 39)

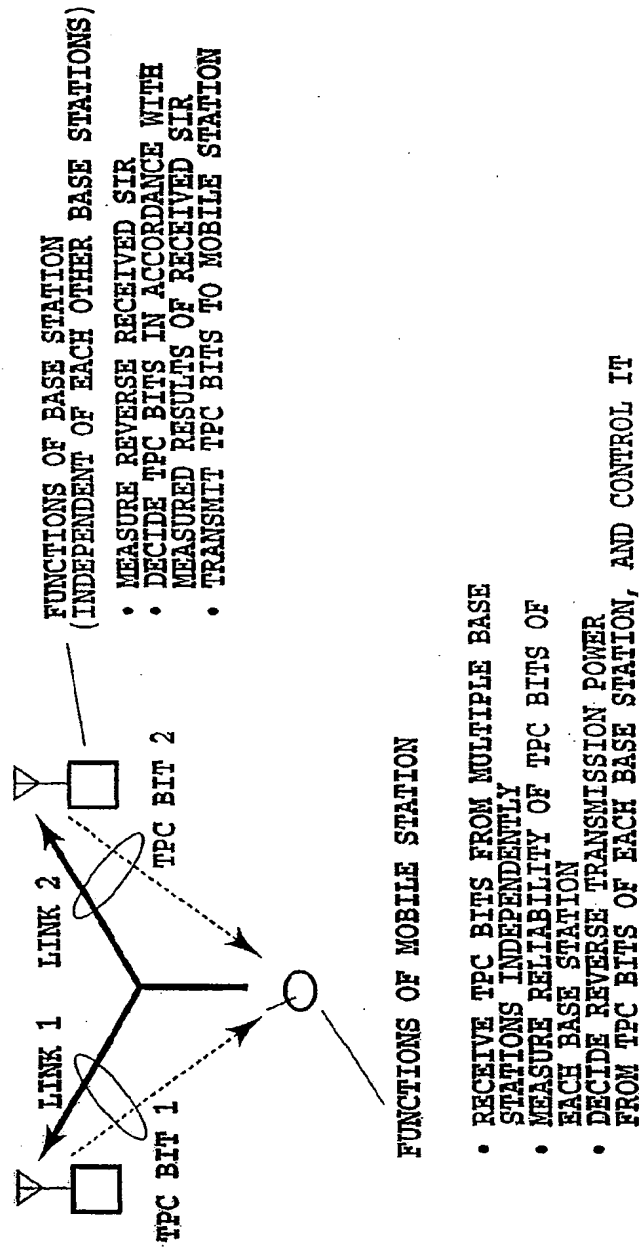


Case Number:DCMH090007

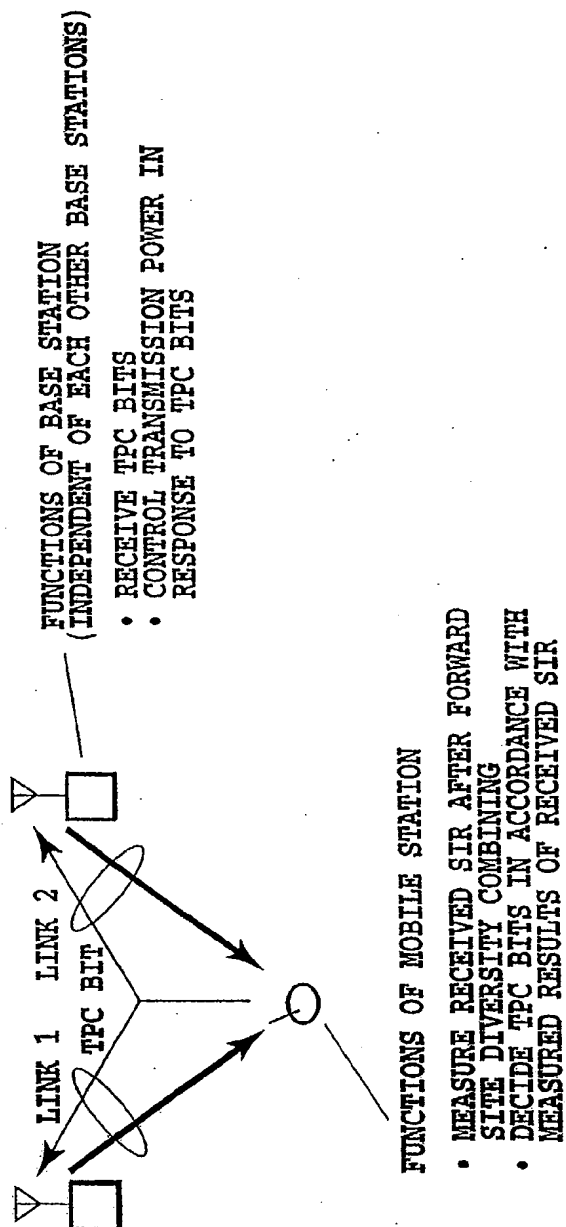
(Fig. 40)



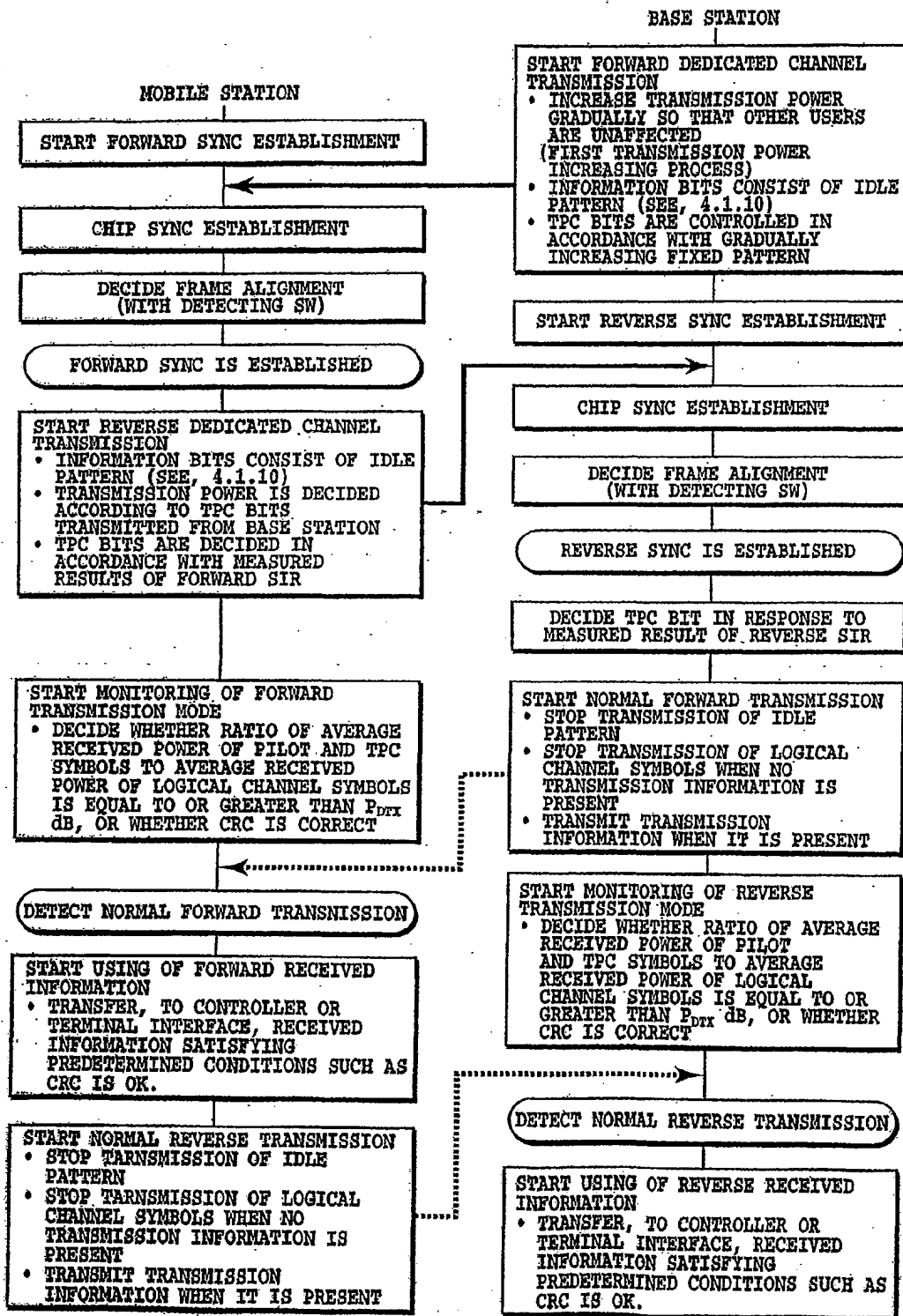
(Fig. 41)



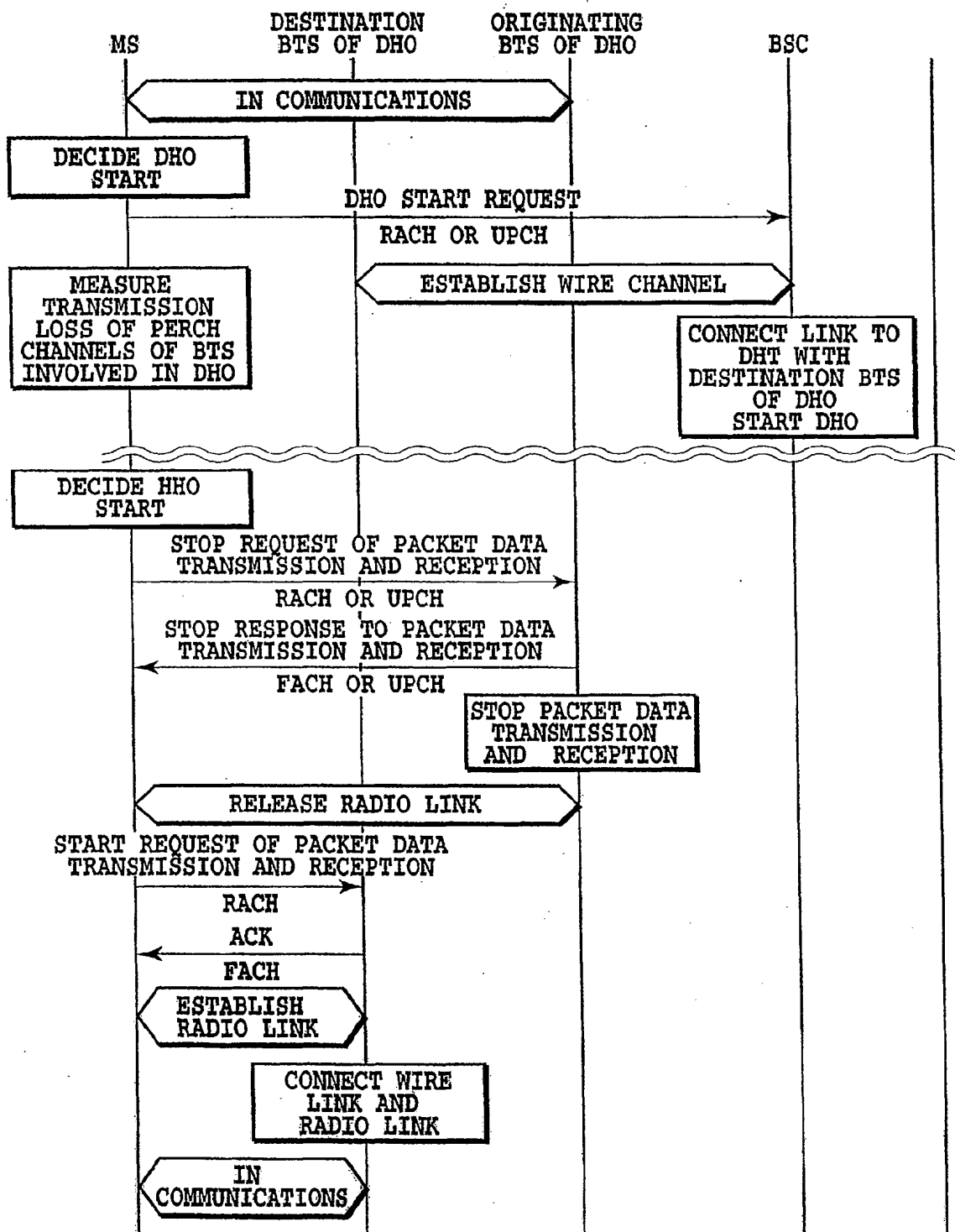
(Fig. 42)



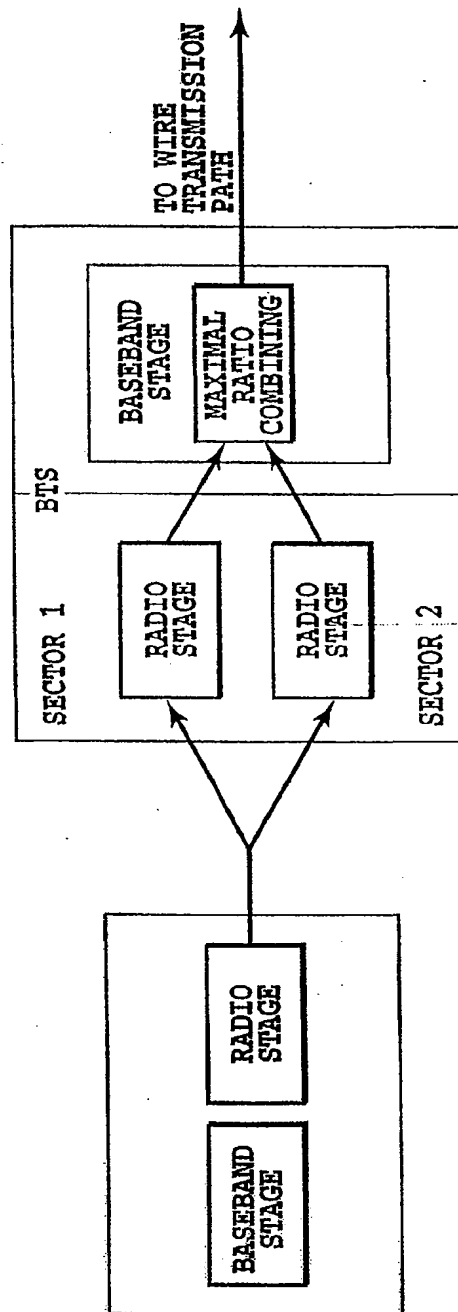
(Fig. 43)



(Fig. 44)

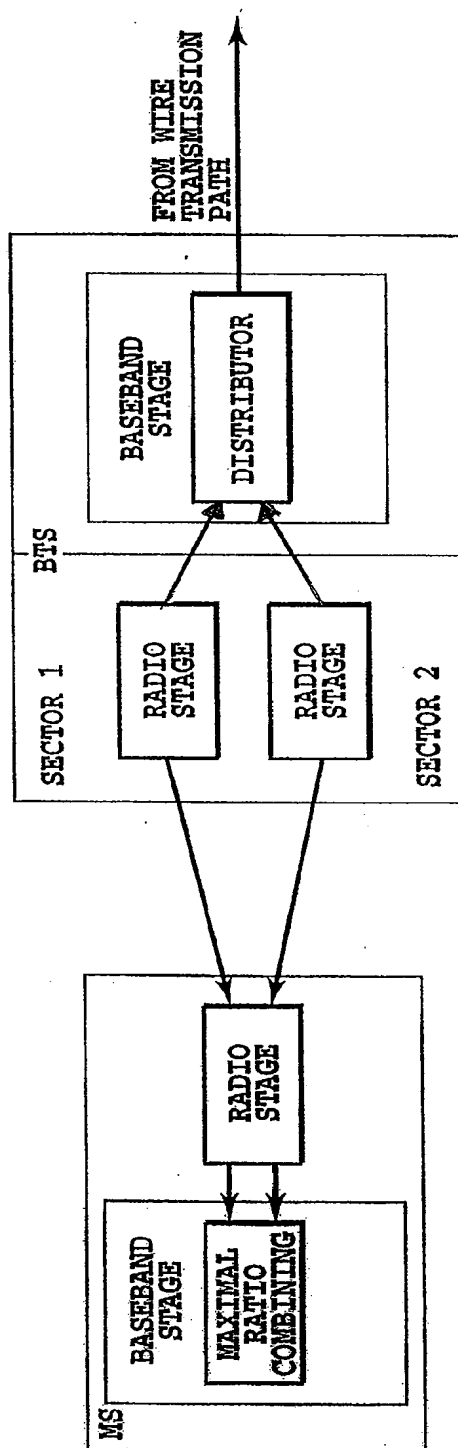


(Fig. 45)



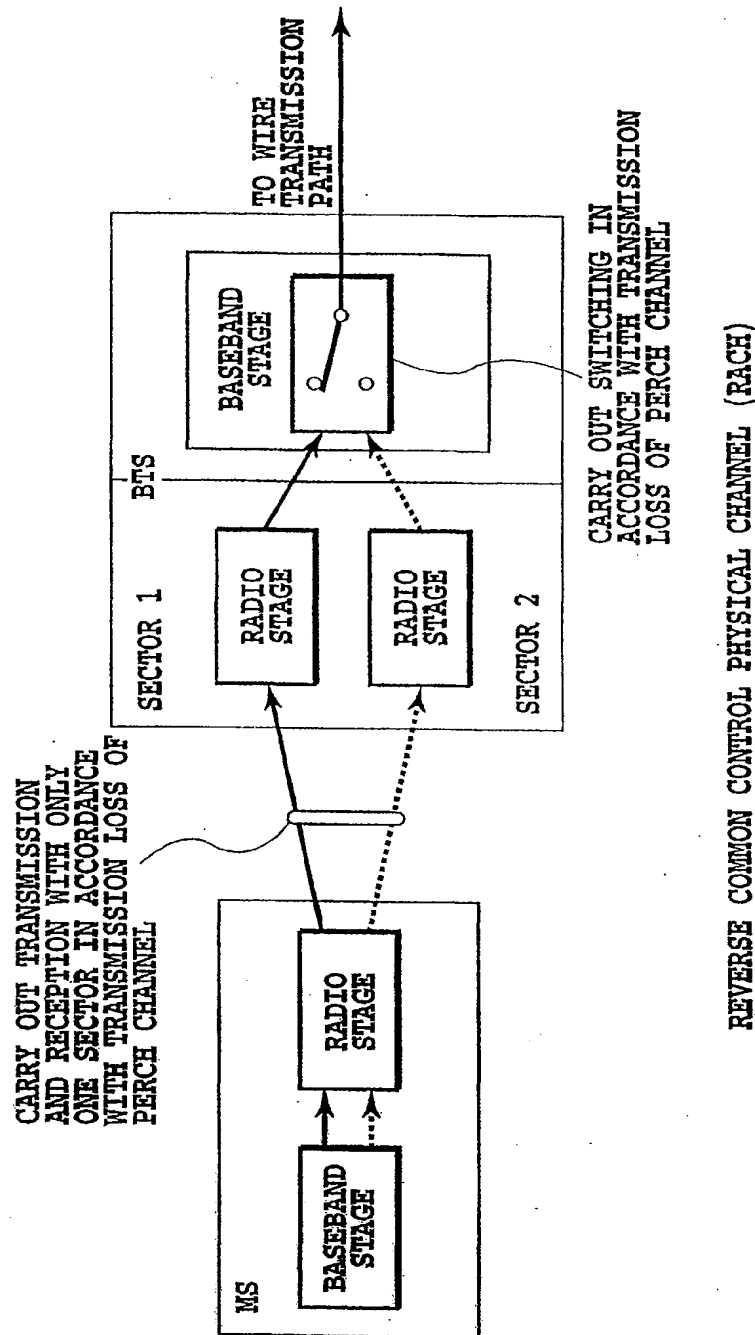
REVERSE DEDICATED PHYSICAL CHANNEL (UPCH)

(Fig. 46)

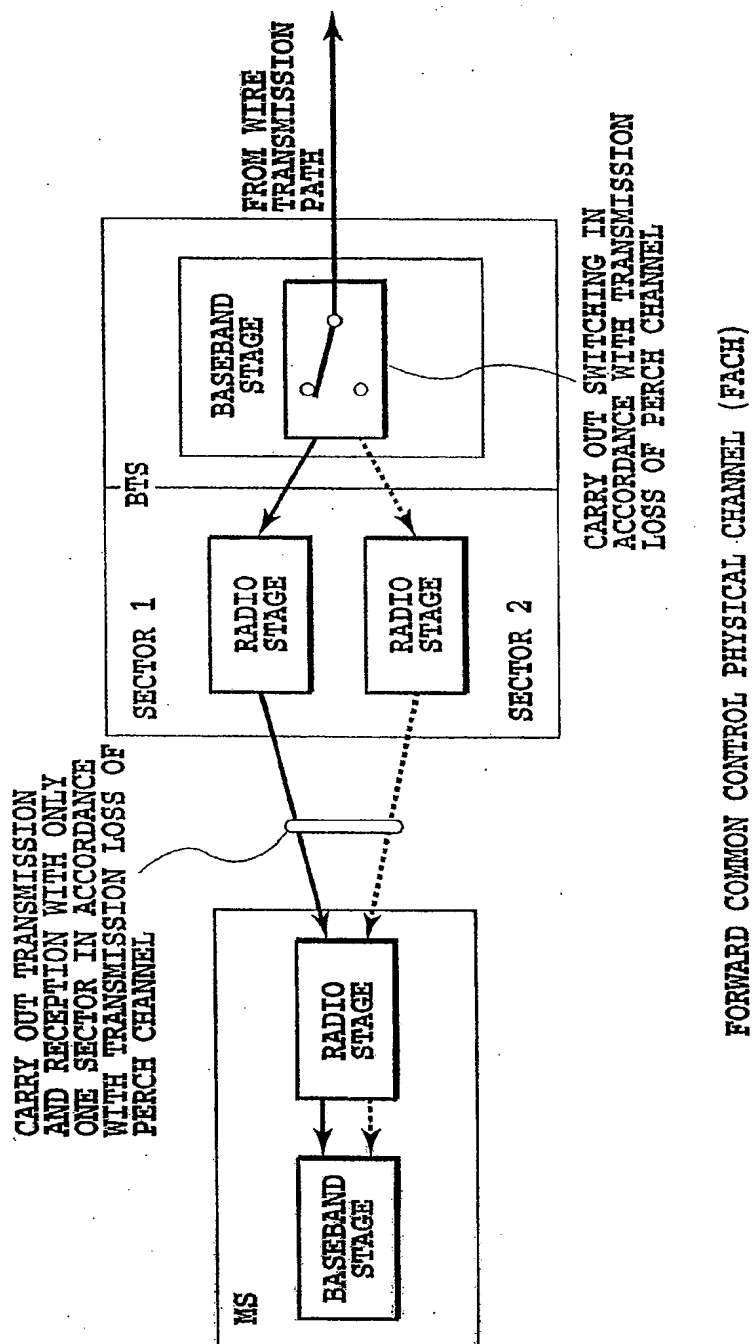


FORWARD DEDICATED PHYSICAL CHANNEL (UPCH)

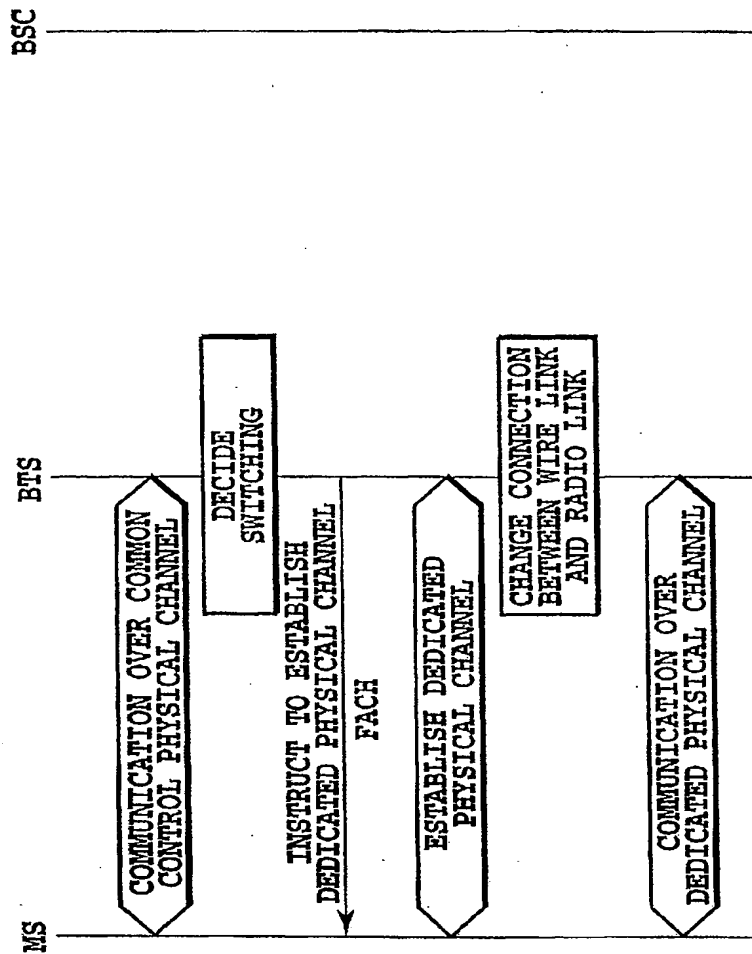
(Fig. 47)



(Fig. 48)

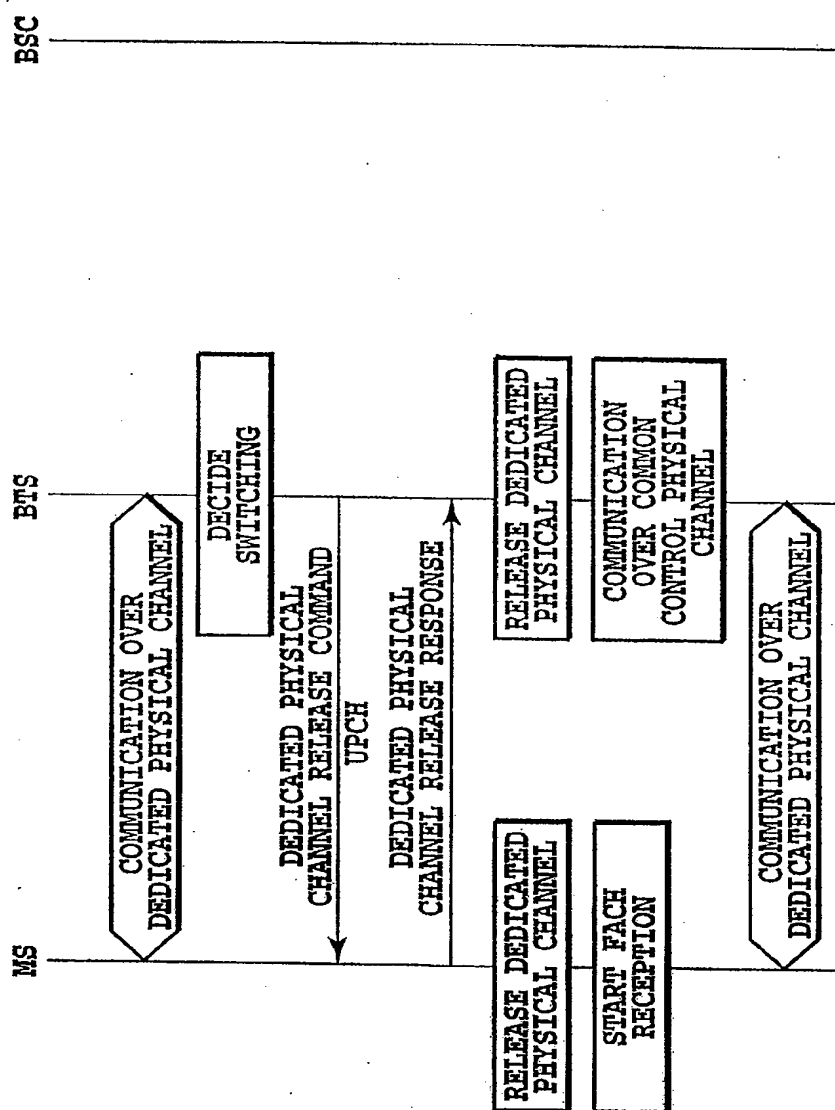


(Fig. 49)



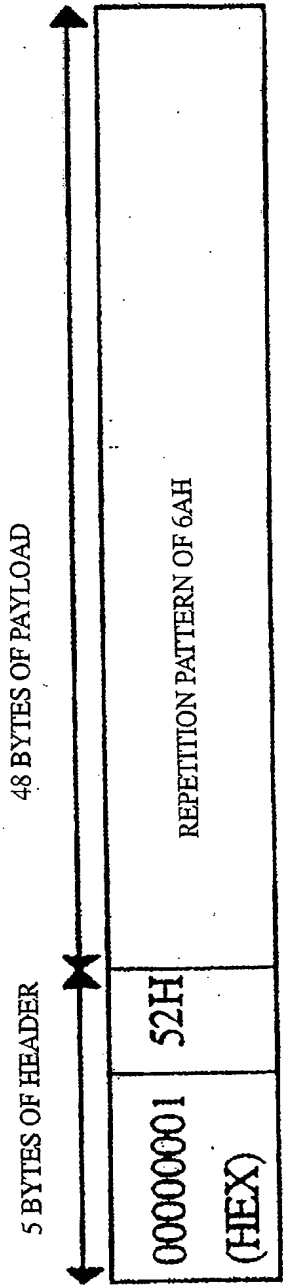
FROM COMMON CONTROL PHYSICAL CHANNEL
TO DEDICATED PHYSICAL CHANNEL

(Fig. 50)

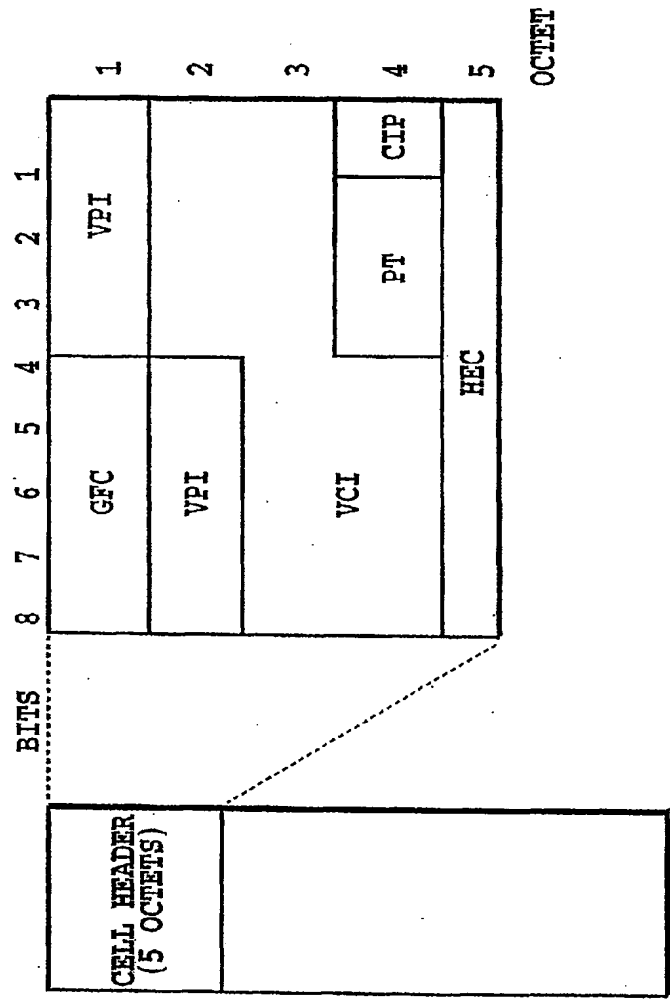


FROM DEDICATED PHYSICAL CHANNEL
TO COMMON CONTROL PHYSICAL CHANNEL

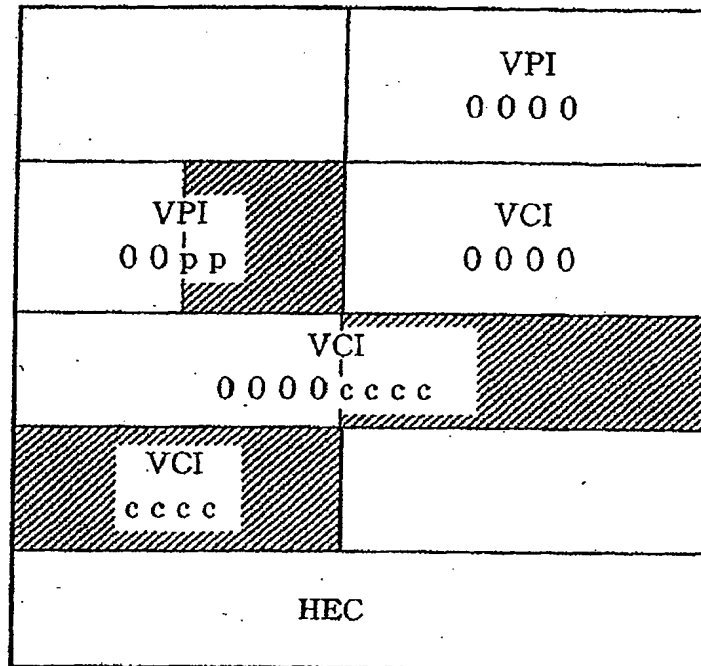
(Fig. 51)



(Fig. 52)



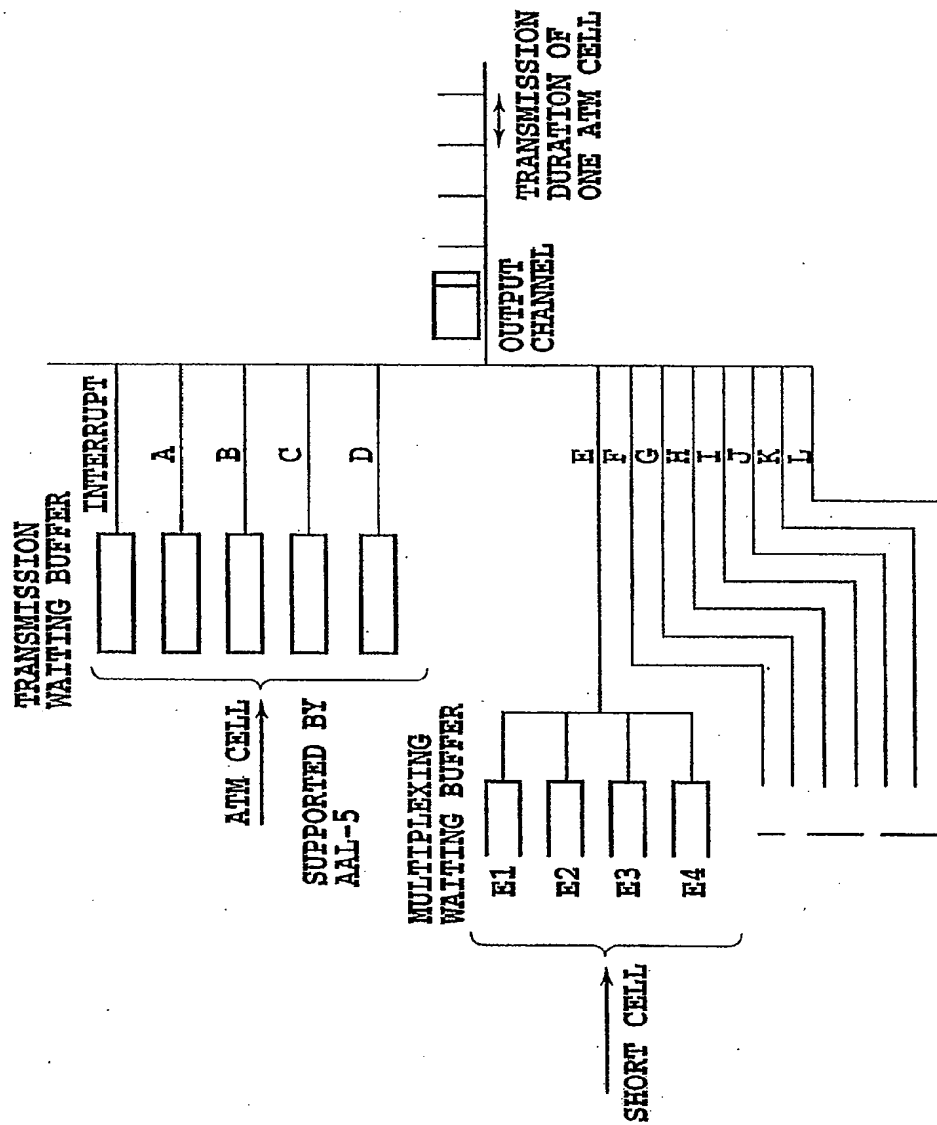
(Fig. 53)



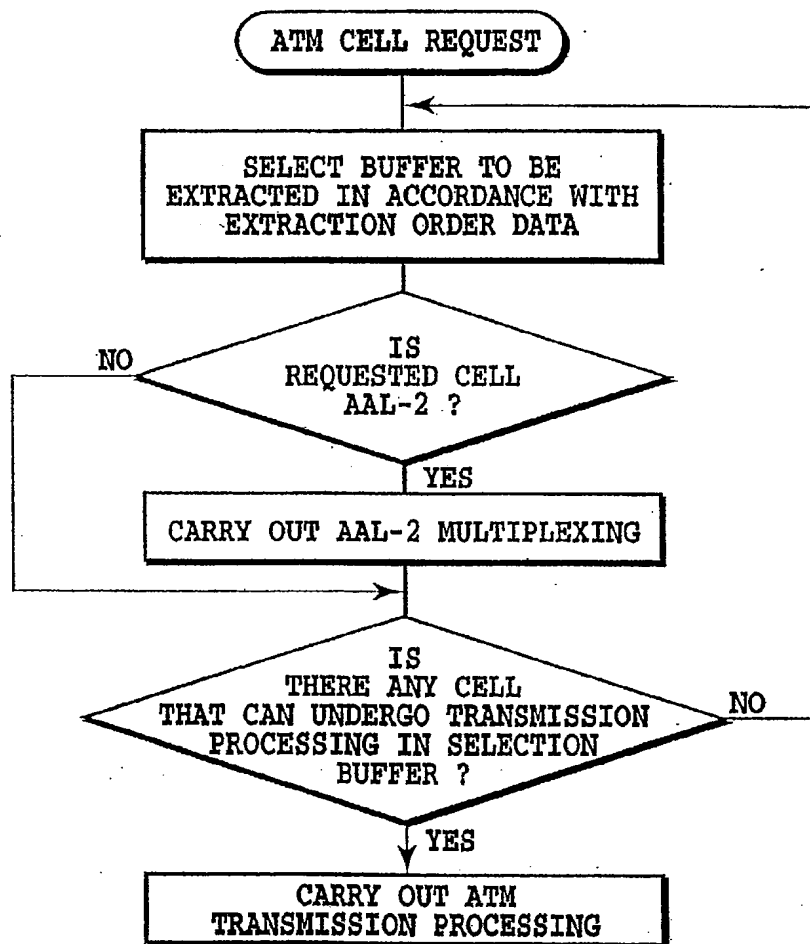
p: BITS USED BY VPI

V: BITS USED BY VCI

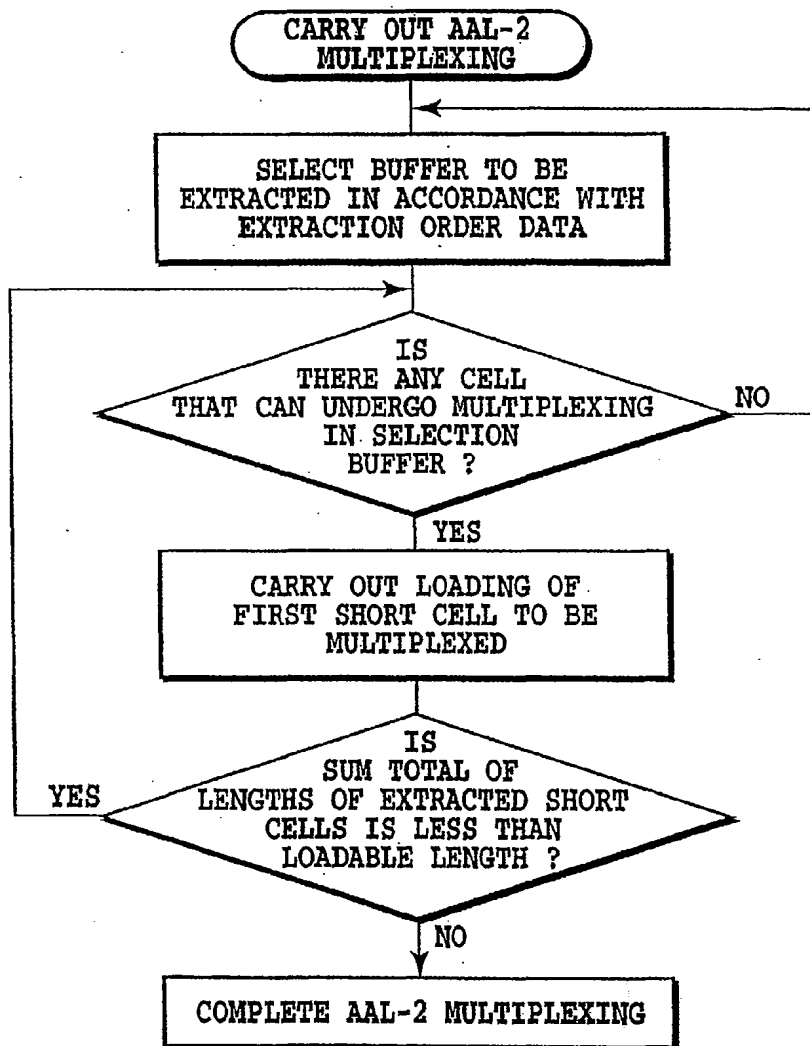
(Fig. 54).



(Fig. 55)



(Fig. 56)



(Fig. 57)

(a)

ATM CELL TRANSMISSION SEQUENCE TABLE
TRANSMISSION ORDER (ABOUT 256 AT MAXIMUM)

PRIORITY ↓	E	F	A	E	F	B	E	F	C	E	. . .
	F	A	B	F	A	C	F	A	D	F	. . .
	A	B	C	A	B	D	A	B	E	A	. . .
	B	C	D	B	C	E	B	C	F	B	. . .
	C	D	E	C	D	F	C	D	A	C	. . .
	D	E	F	D	E	A	D	E	B	D	. . .

(b)

SHORT CELL TRANSMISSION SEQUENCE TABLE
(QUALITY CLASS (6))
TRANSMISSION ORDER (ABOUT 128 AT MAXIMUM)

PRIORITY ↓	E1	E1	E1	E2	E1	E1	E1	E3	. . .
	E2	E2	E2	E3	E2	E2	E2	E4	. . .
	E3	E3	E3	E4	E3	E3	E3	E1	. . .
	E4	E4	E4	E1	E4	E4	E4	E2	. . .

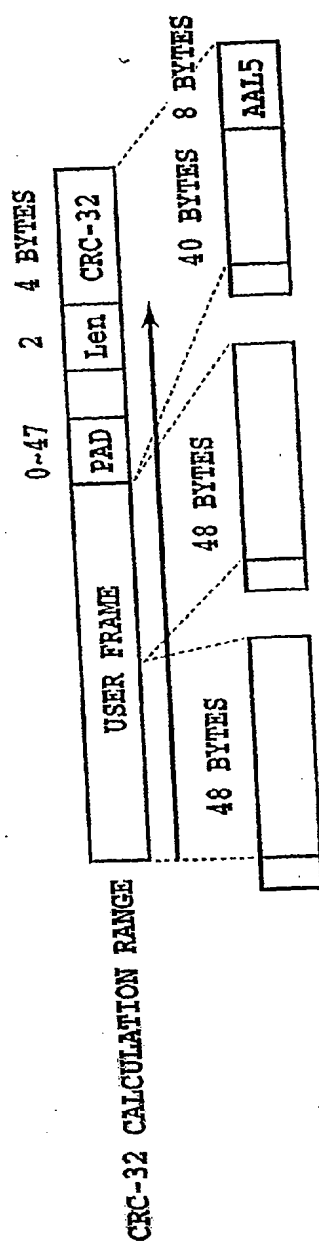
(c)

SHORT CELL TRANSMISSION SEQUENCE TABLE
(QUALITY CLASS (7))
TRANSMISSION ORDER (ABOUT 128 AT MAXIMUM)

PRIORITY ↓	F1	F1	F2	F1	F1	F3	F1	F1	. . .
	F2	F2	F3	F2	F2	F4	F2	F2	. . .
	F3	F3	F4	F3	F3	F1	F3	F3	. . .
	F4	F4	F1	F4	F4	F2	F4	F4	. . .

- CARRY OUT CELL EXTRACTION PROCESSING IN ACCORDANCE WITH TRANSMISSION SEQUENCE DETERMINED FOR EACH OUTPUT TIMING.
- IF NO CELL IS PRESENT IN HIGHER PRIORITY QUALITY CLASS, A CELL IN THE NEXT PRIORITY IS EXTRACTED.

(Fig. 58)



PAD : PADDING BITS (ALL "0s")
 Len : NUMBER OF BYTES OF EFFECTIVE DATA LENGTH OF USER FRAME
 CRC-32 : CRC CHECKING BITS OVER 32 BITS
 CRC-32 : GENERATOR POLYNOMIAL
 $G(X) = X^{32} + X^{26} + X^{23} + X^{22} + X^{16} + X^{12} + X^{11} + X^{10} + X^8 + X^7 + X^5 + X^4 + X^2 + X + 1$
 CHECK BITS ARE OBTAINED BY INVERTING BITS OF REMAINDER GENERATED BY THE GENERATOR POLYNOMIAL.

**BASE
STATION**

The diagram illustrates the BSC protocol sequence. It shows a series of frames transmitted between two parties. The frames are: BGN, BGAk, POLL, SD, STAT, SD, SD, SD, SD, SD, STAT, POLL, SD, SD, SD, END, and ENDAk. The diagram uses solid lines for data frames and dashed lines for control frames. The sequence starts with BGN, followed by BGAk, then POLL. This is followed by a series of SD frames, then STAT, then POLL, then SD, SD, SD, then END, and finally ENDAk.

BGN : REQUEST FOR ESTABLISHING
SSCOP CONNECTION.

BGAK : NOTIFY THAT REQUEST FOR
ESTABLISHING SSCOP CONNECTION
IS ACCEPTED.

POLL : INQUIRE FOR RECEIVING SIDE
STATE AT FIXED INTERVALS.

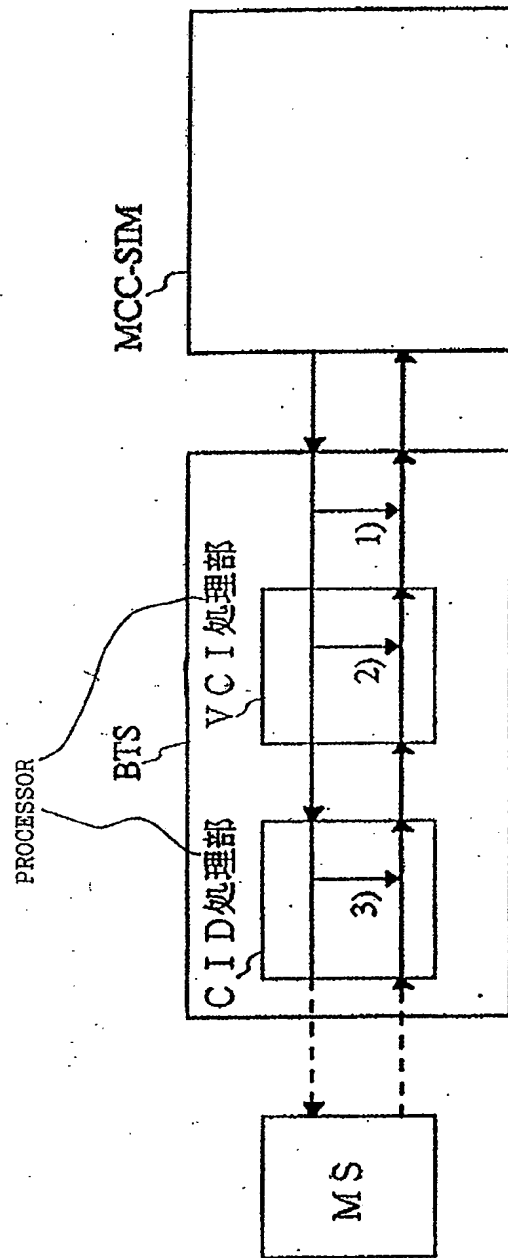
STAT : NOTIFY TRANSMITTING SIDE OF
RECEIVING SIDE STATE IN
RESPONSE TO POLL.
NOTIFY OF ALL ERRORS NOT
YET RECOVERED (INCLUDING
RETRANSMISSION FRAME).

SD : DATA FRAME

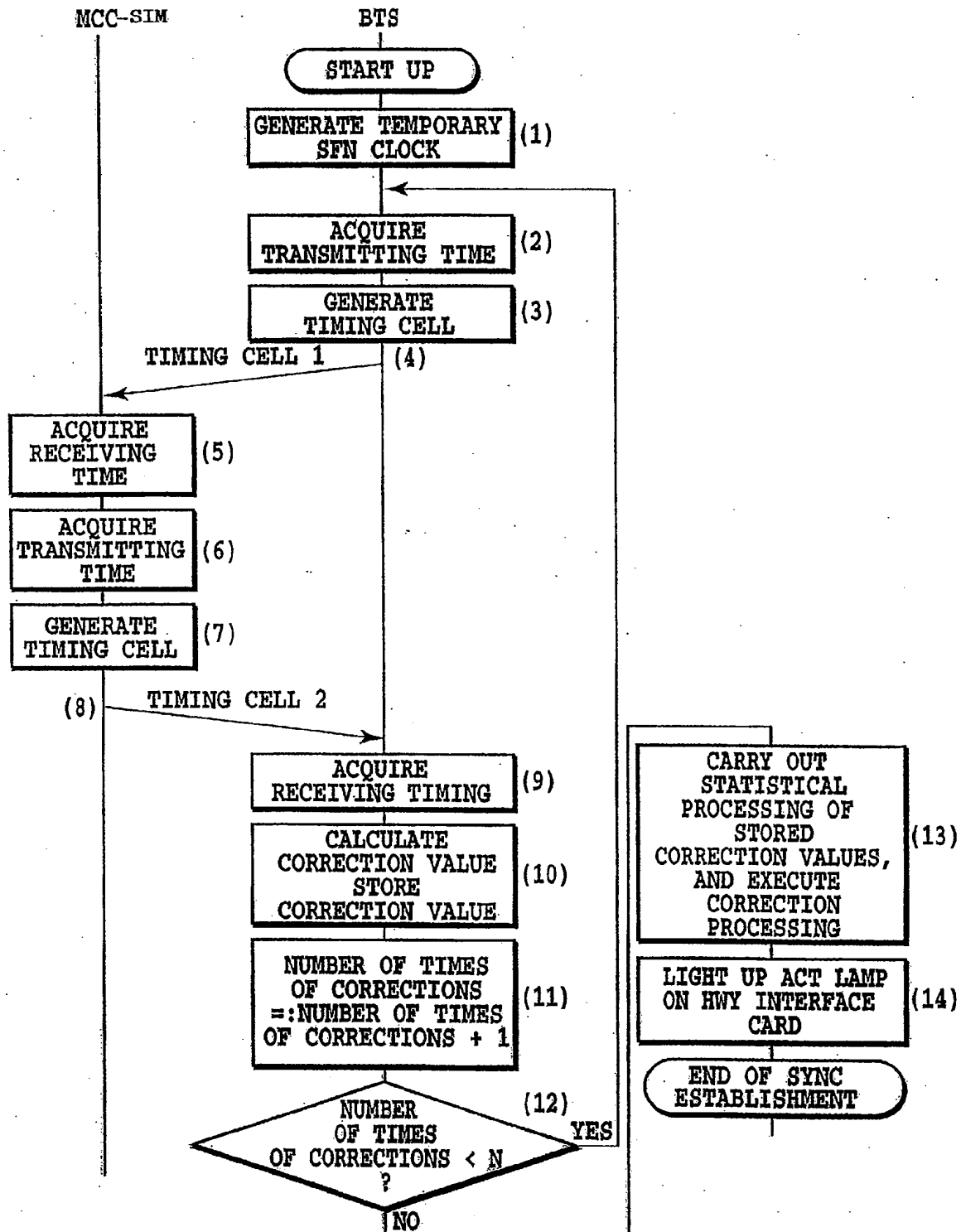
END : REQUEST FOR RELEASING SSCOP
CONNECTION.

ENDAK : NOTIFICATION THAT THE REQUEST
FOR RELEASING SSCOP
CONNECTION IS ACCEPTED.

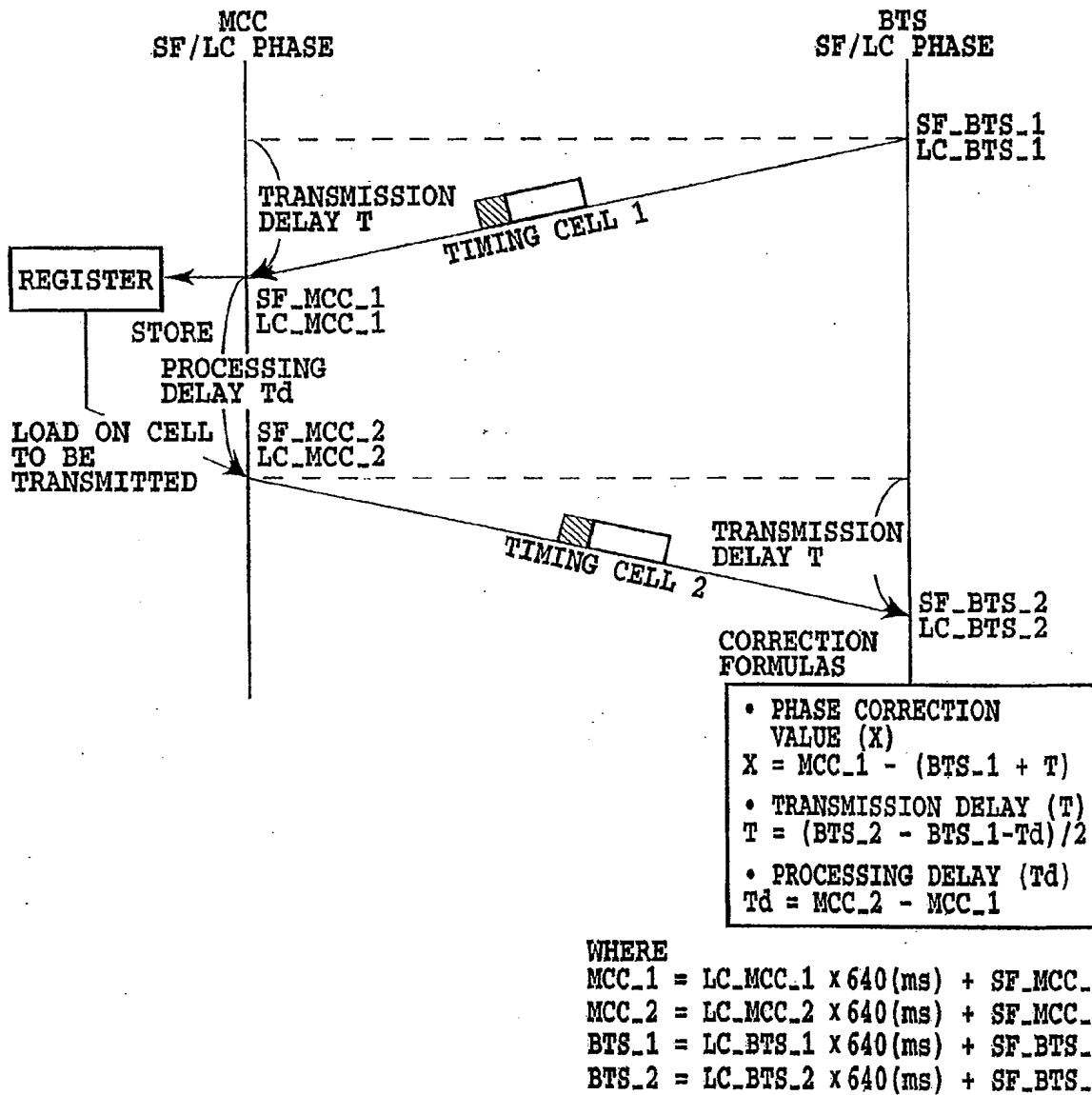
(Fig. 60)



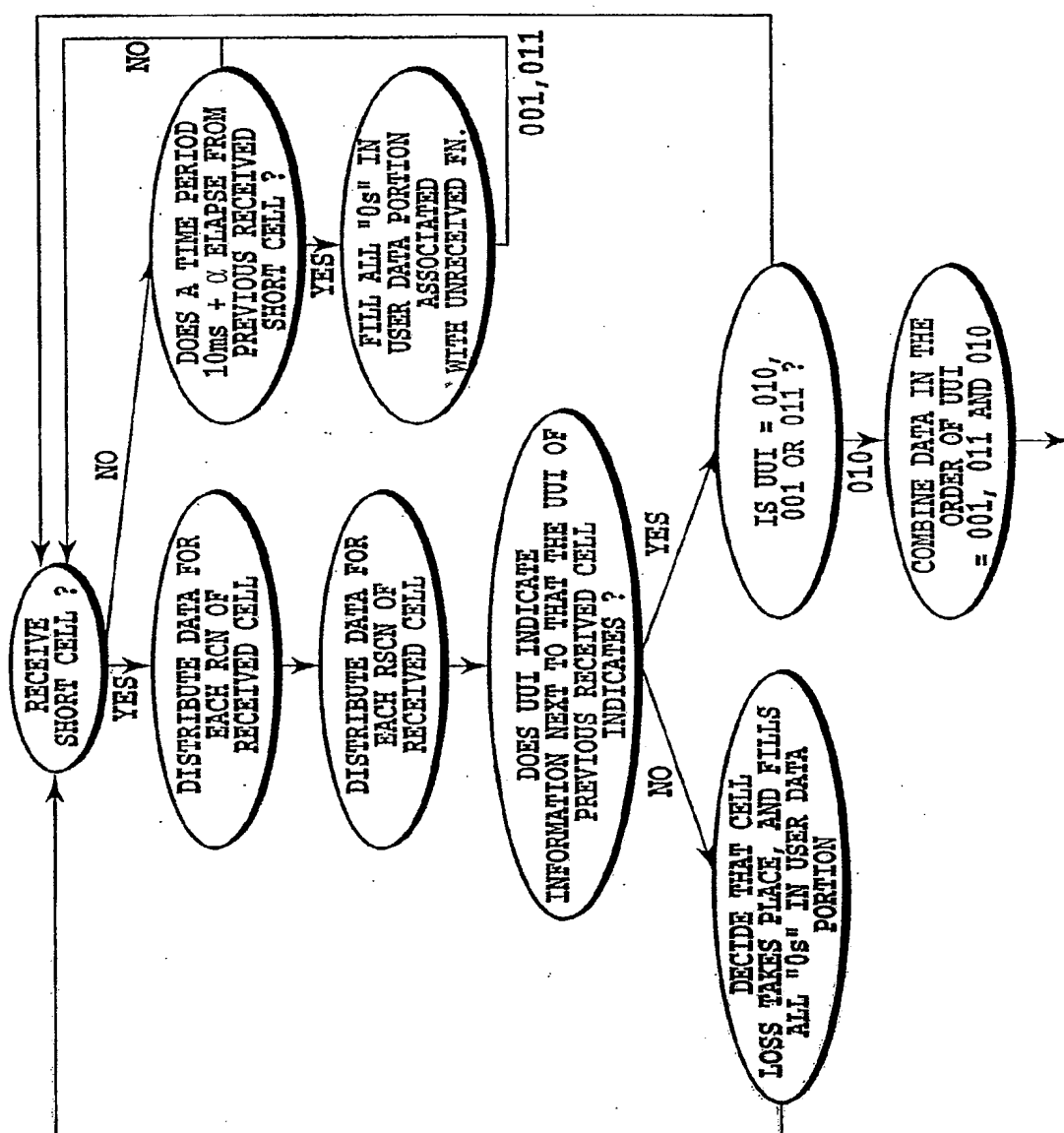
(Fig. 61)



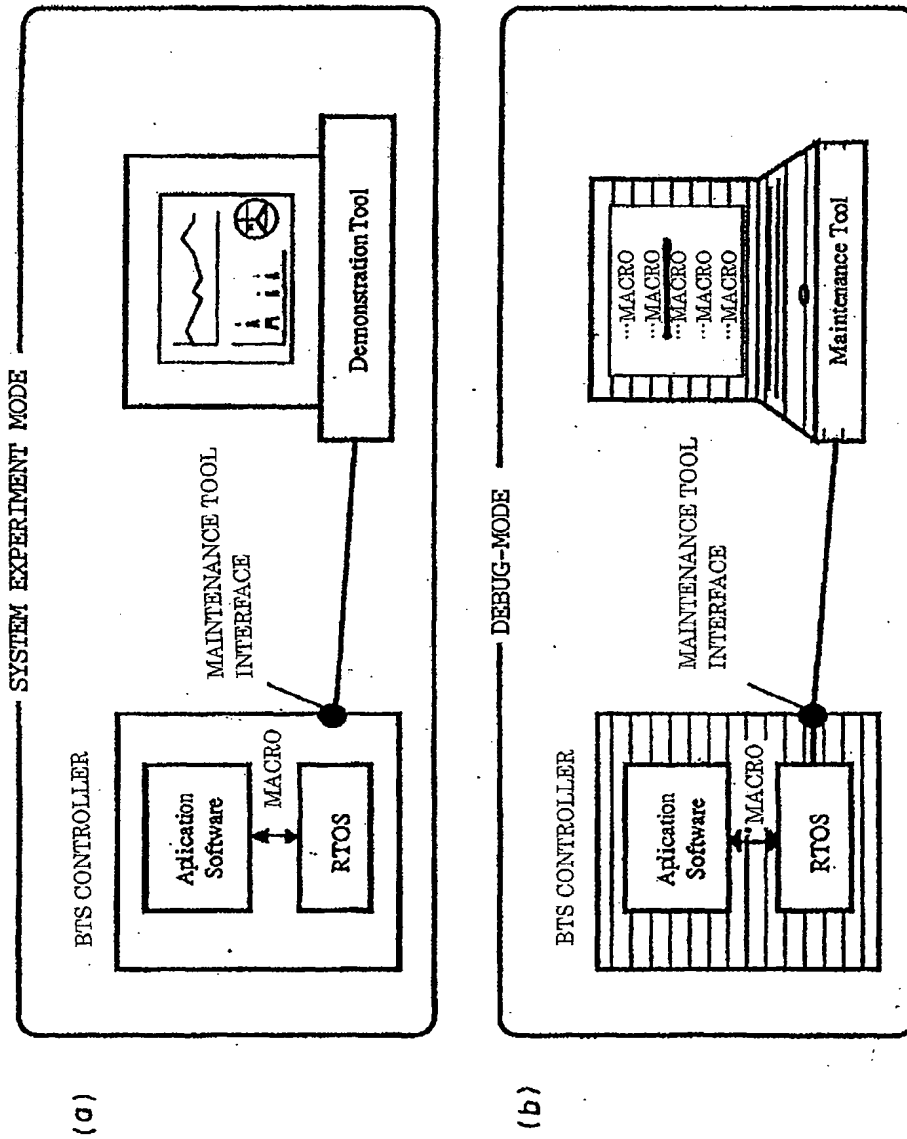
(Fig. 62)



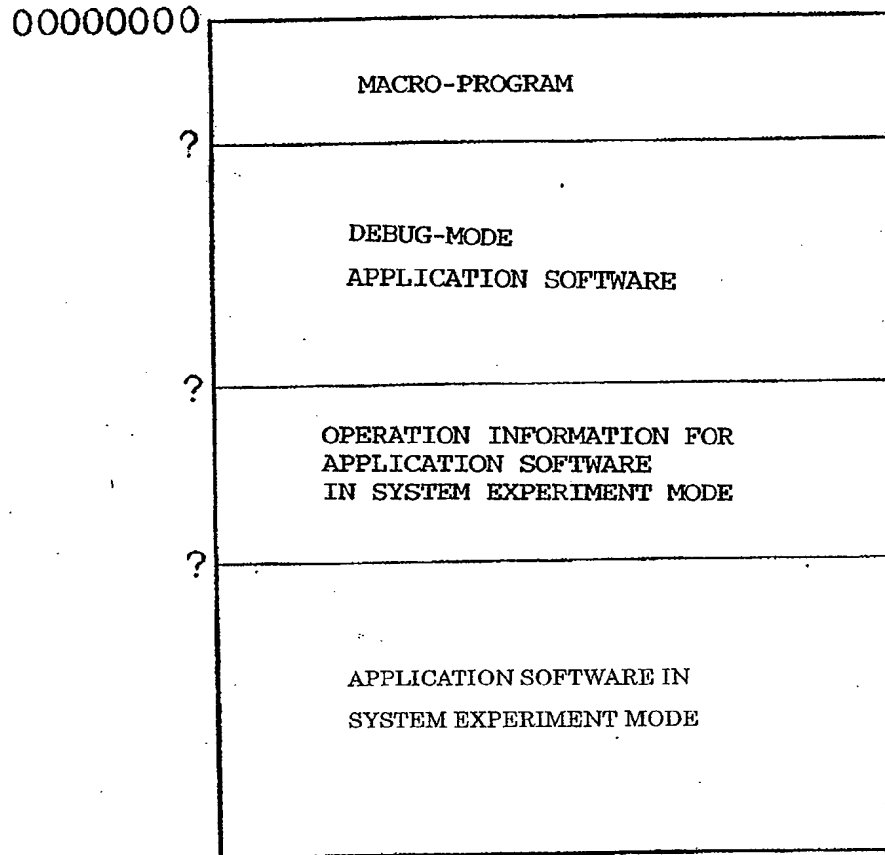
(Fig. 63)



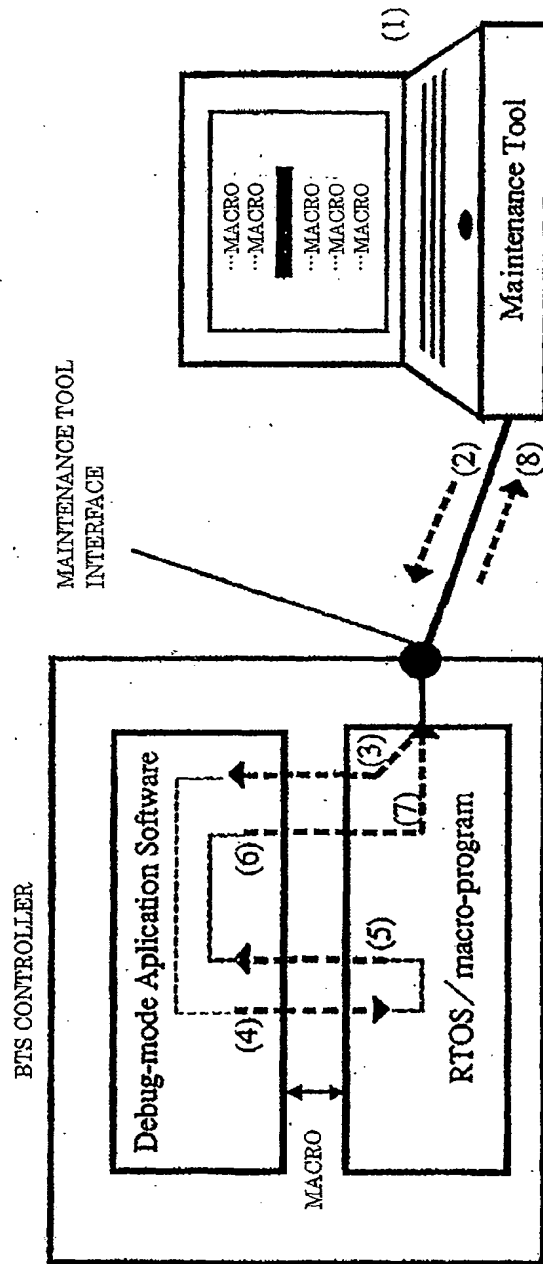
(Fig. 64)



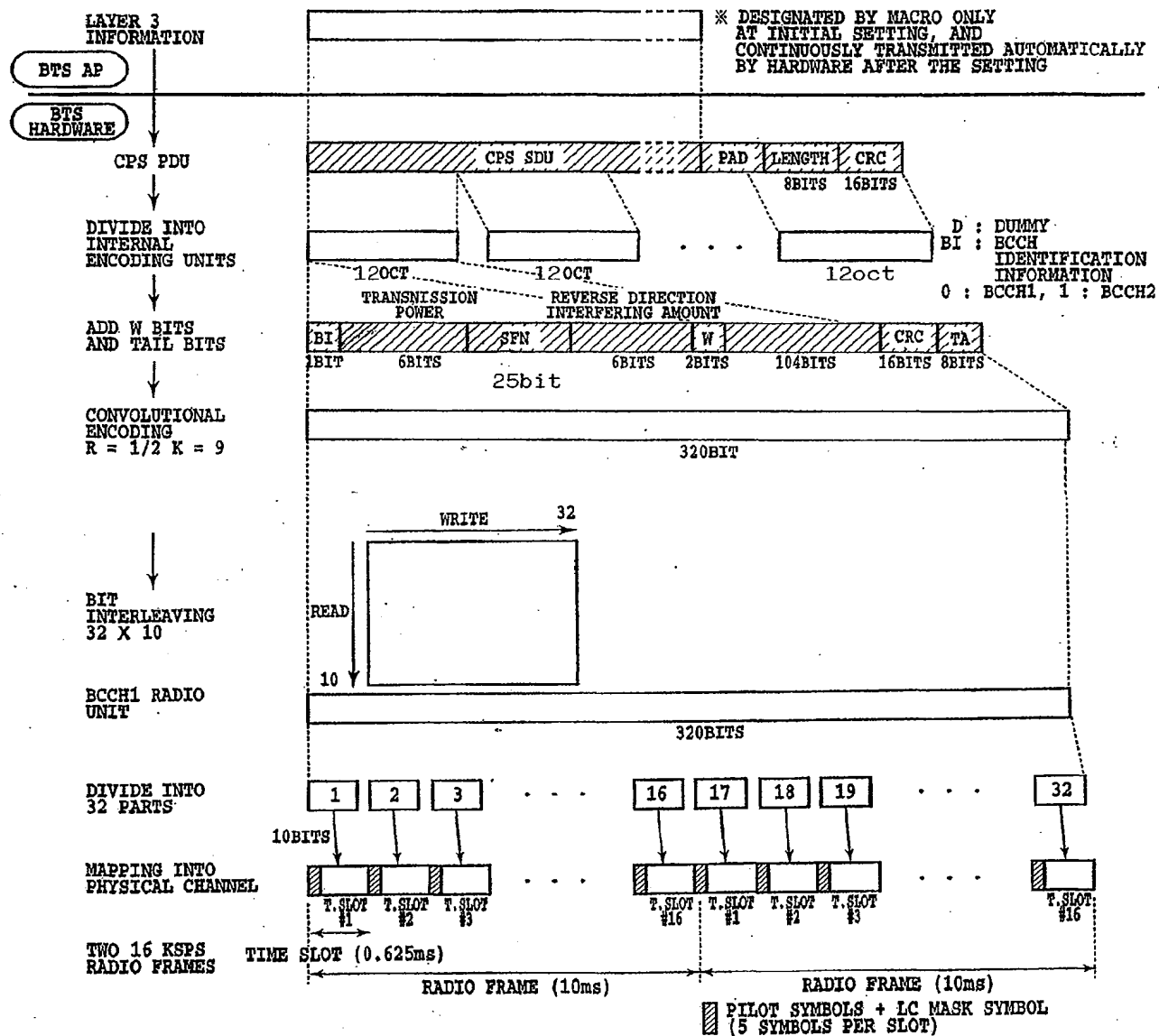
(Fig. 65)



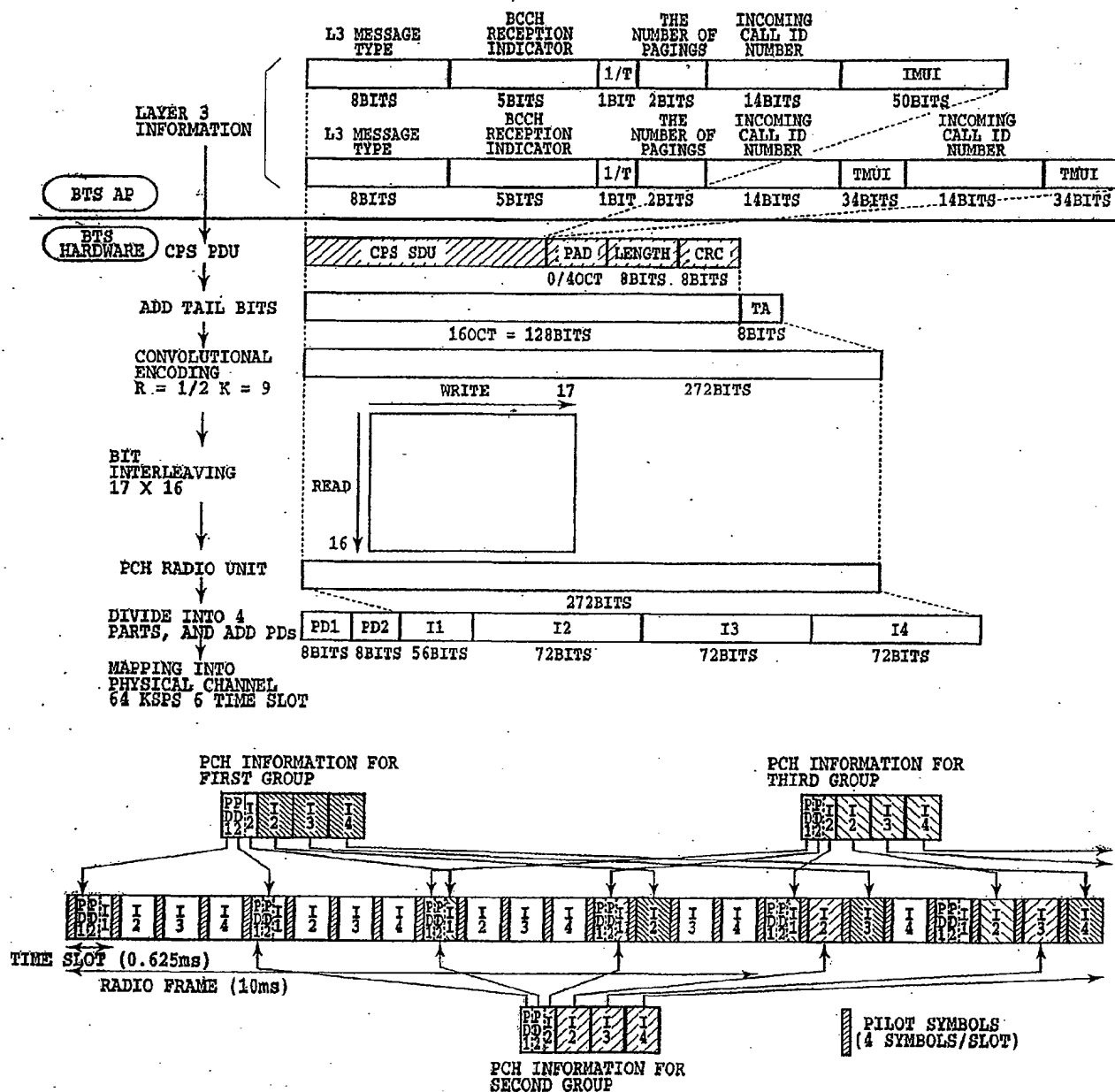
(Fig. 66)

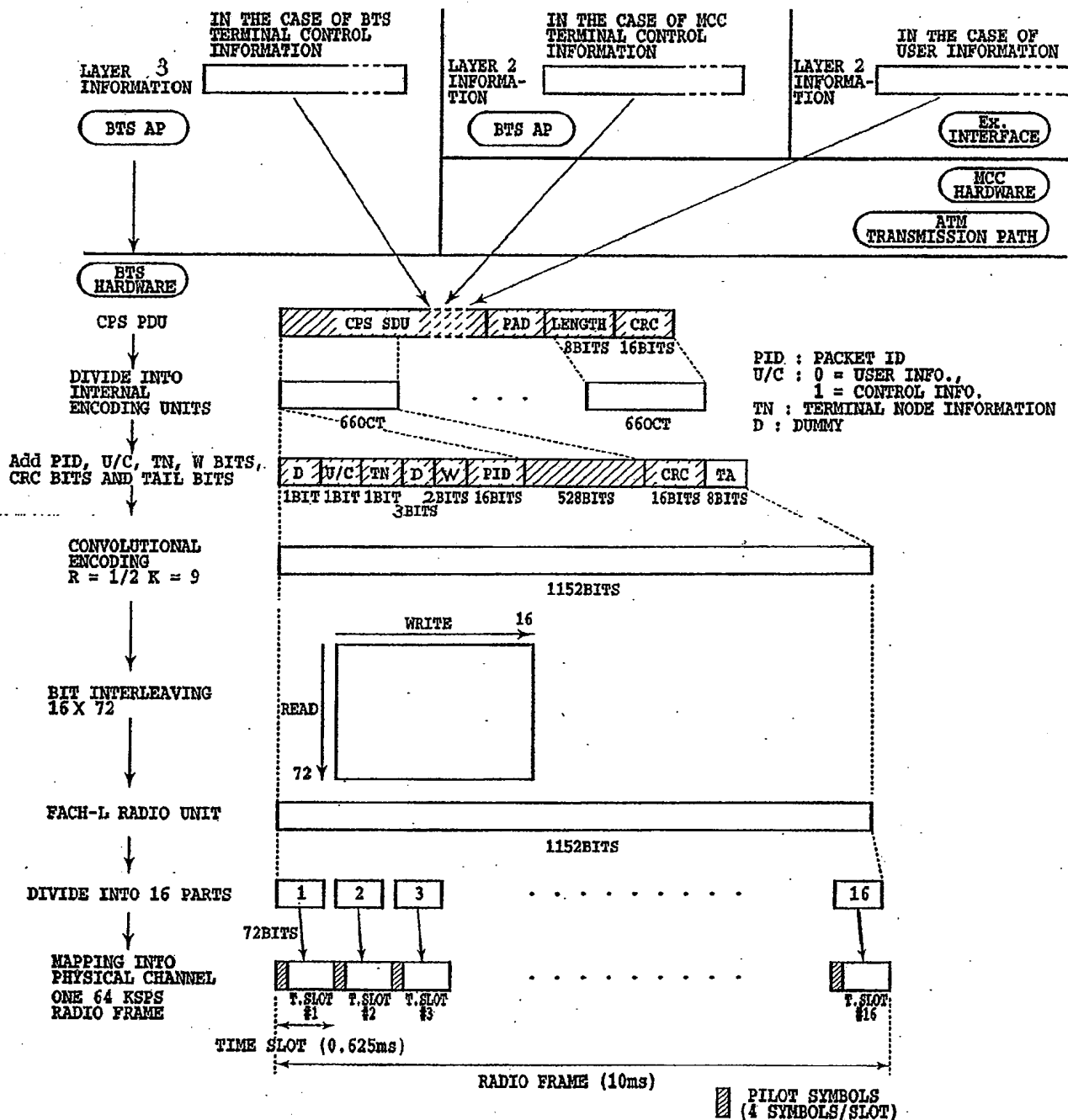


(Fig. 67)

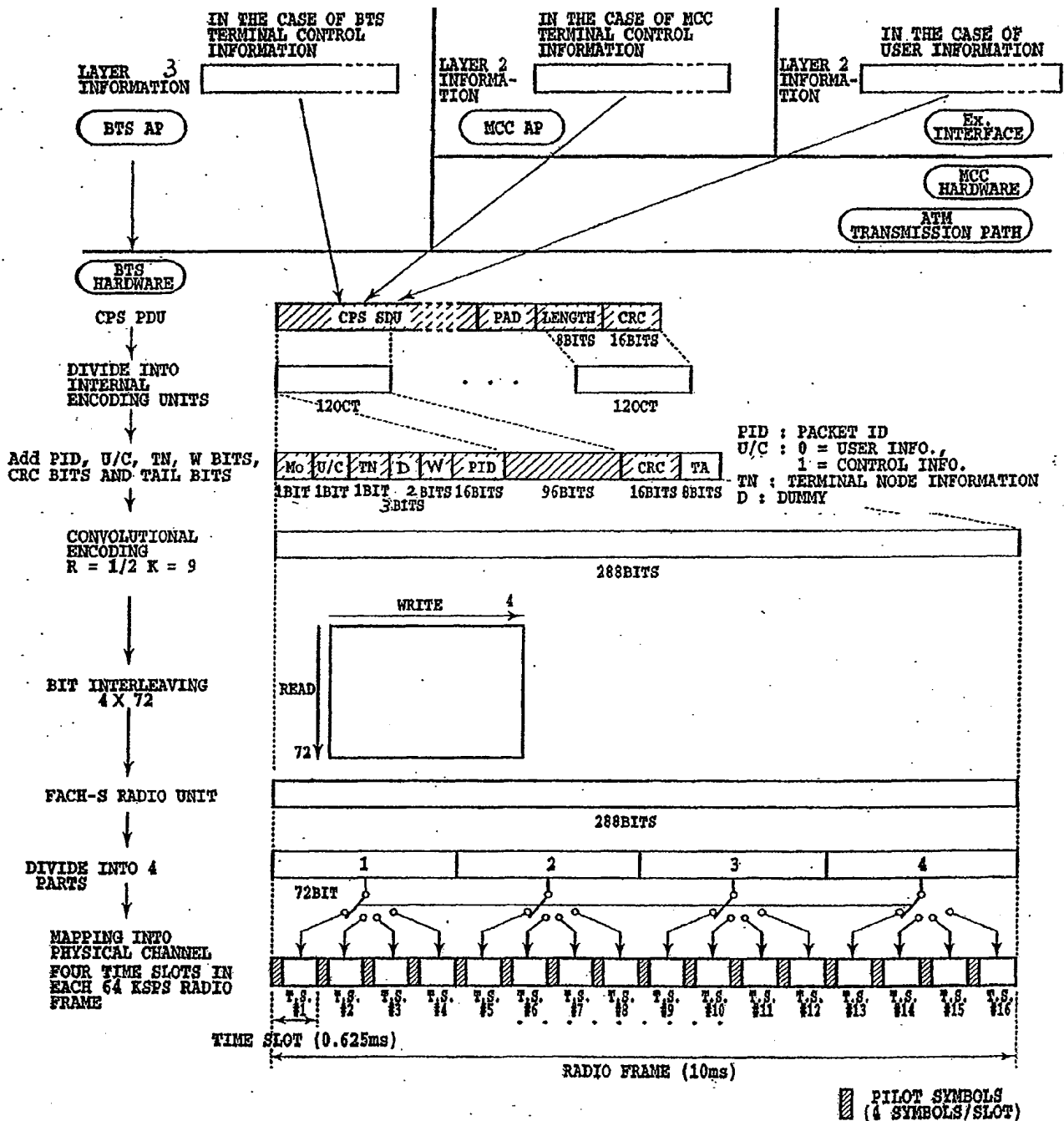


(Fig. 68)

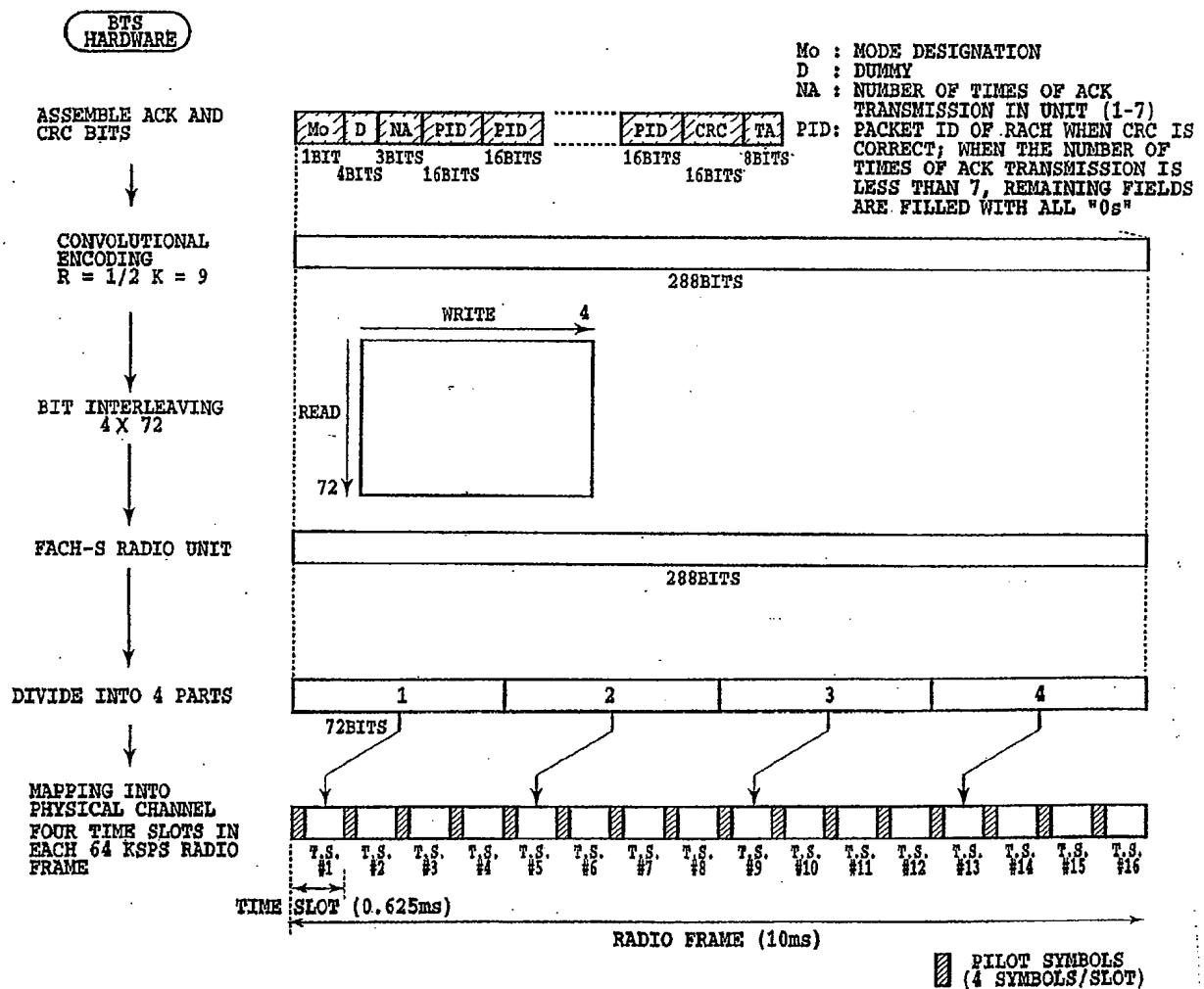




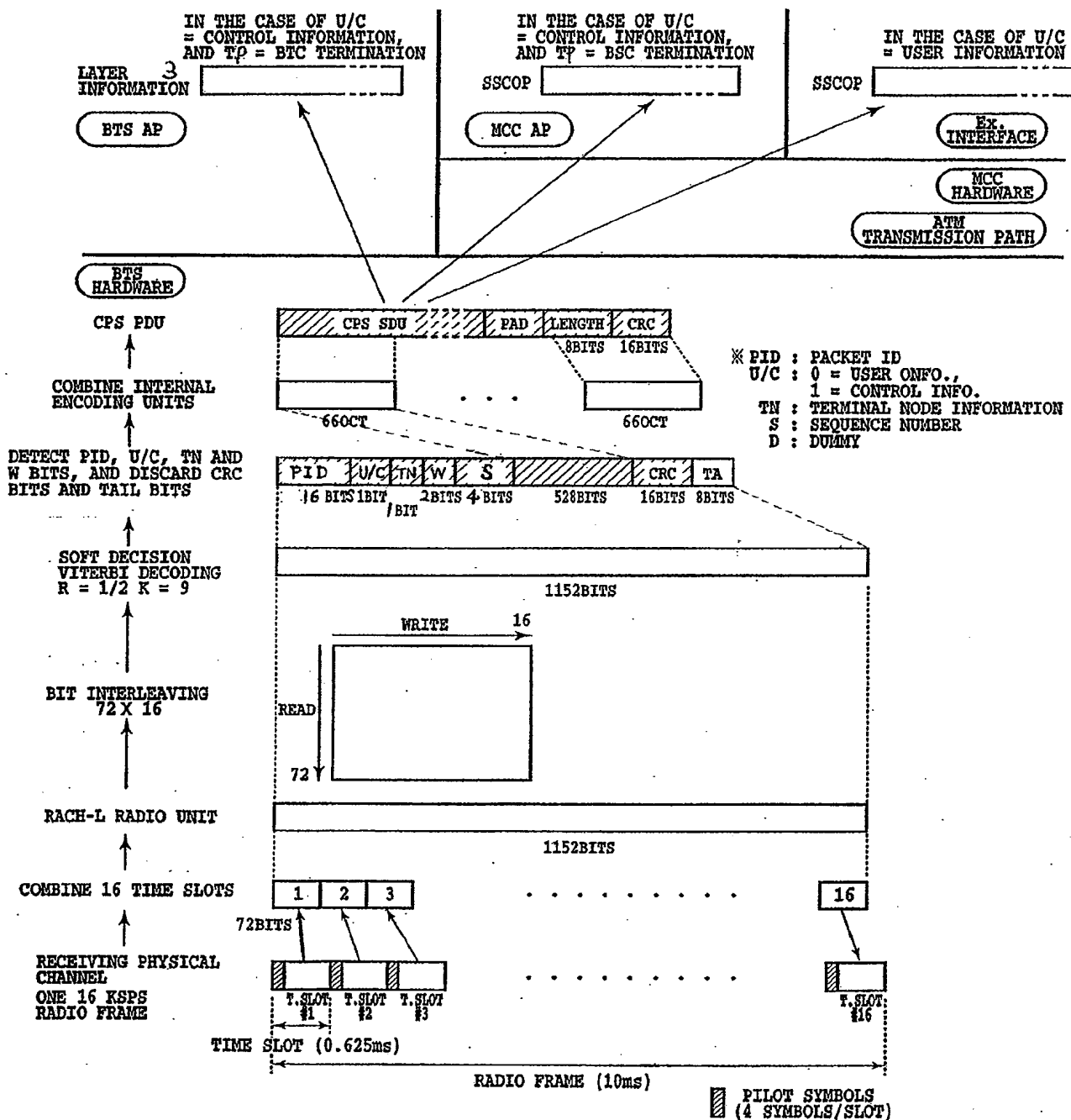
(Fig. 70)



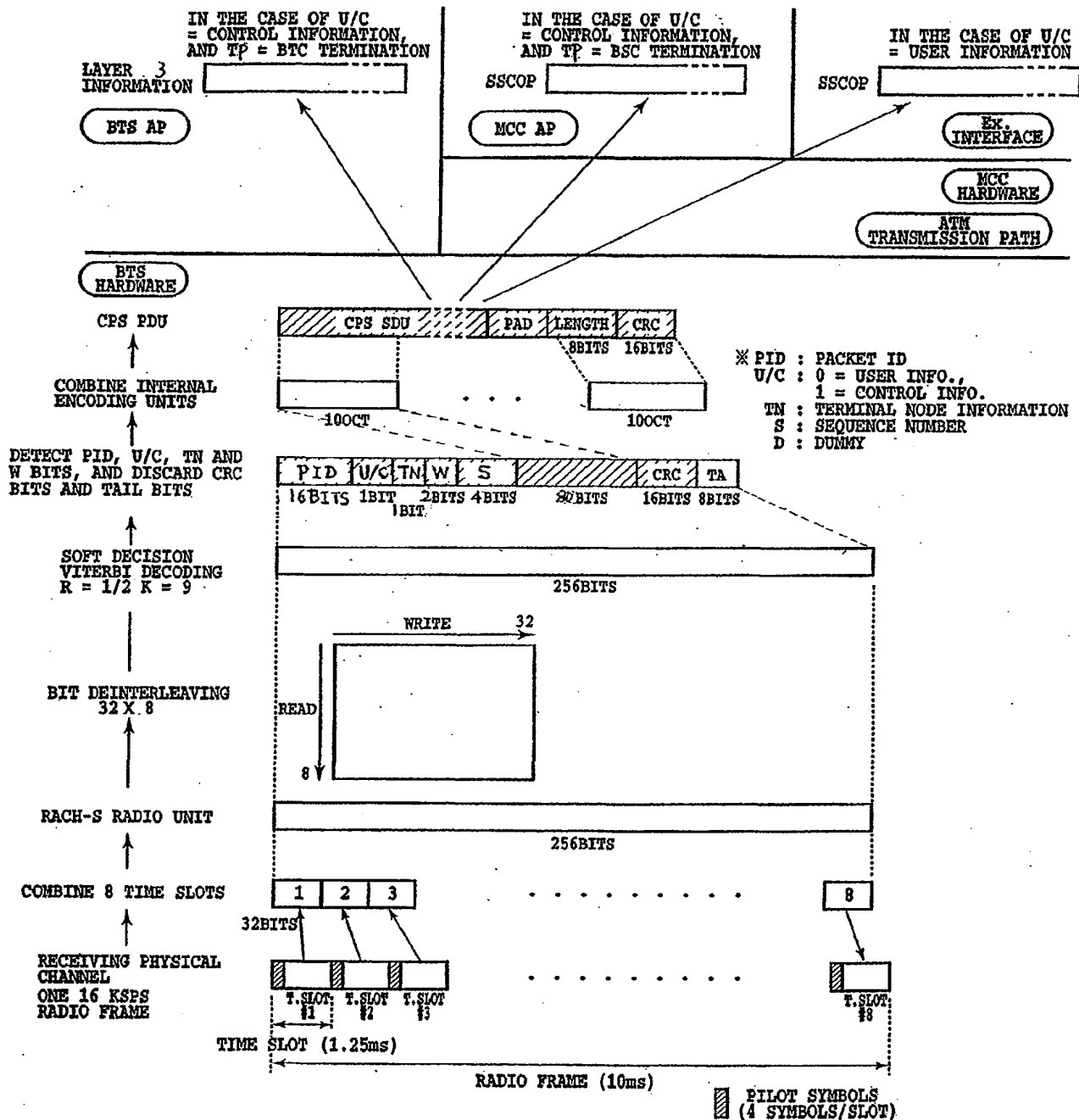
(Fig. 71)



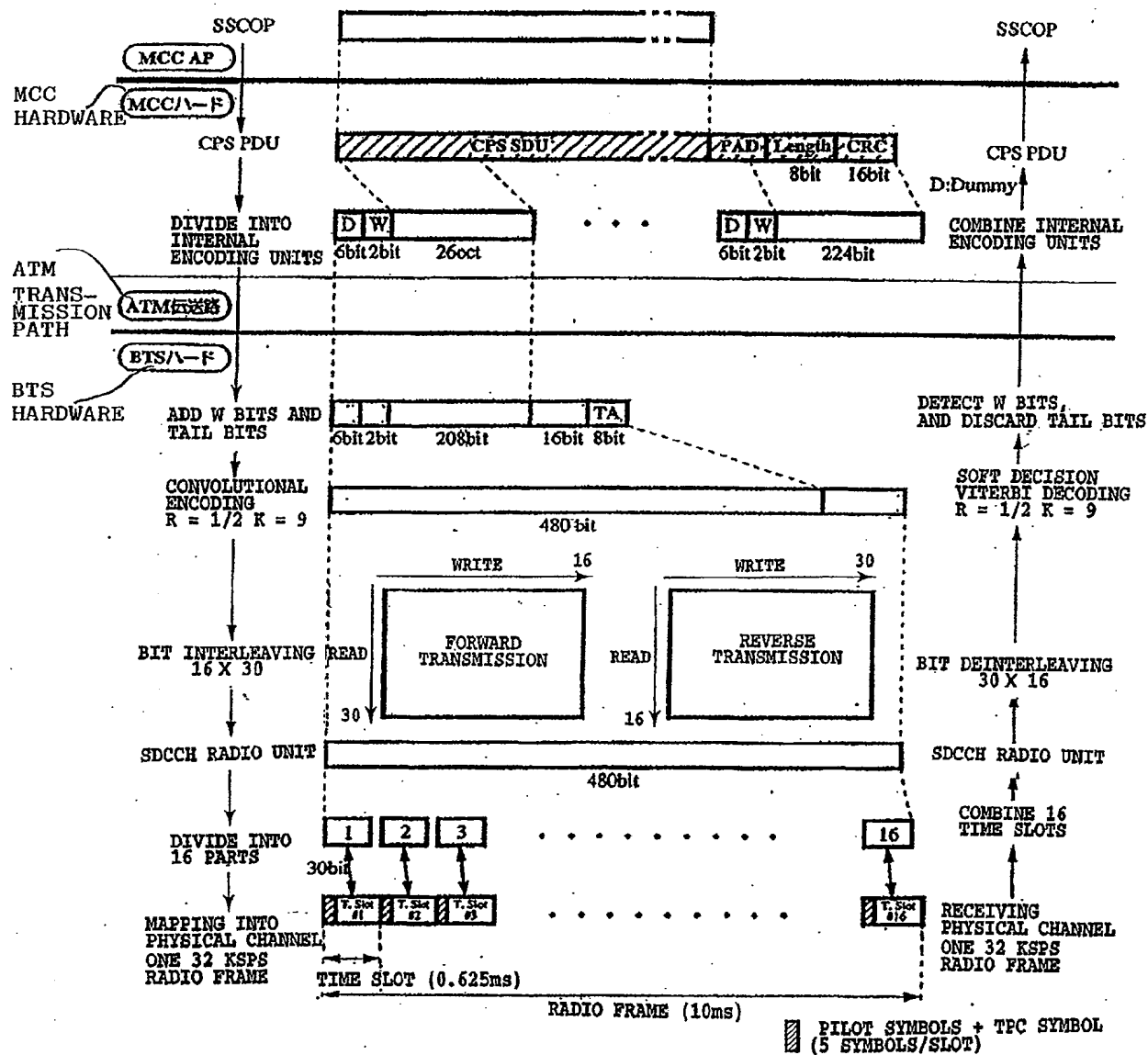
(Fig. 72)



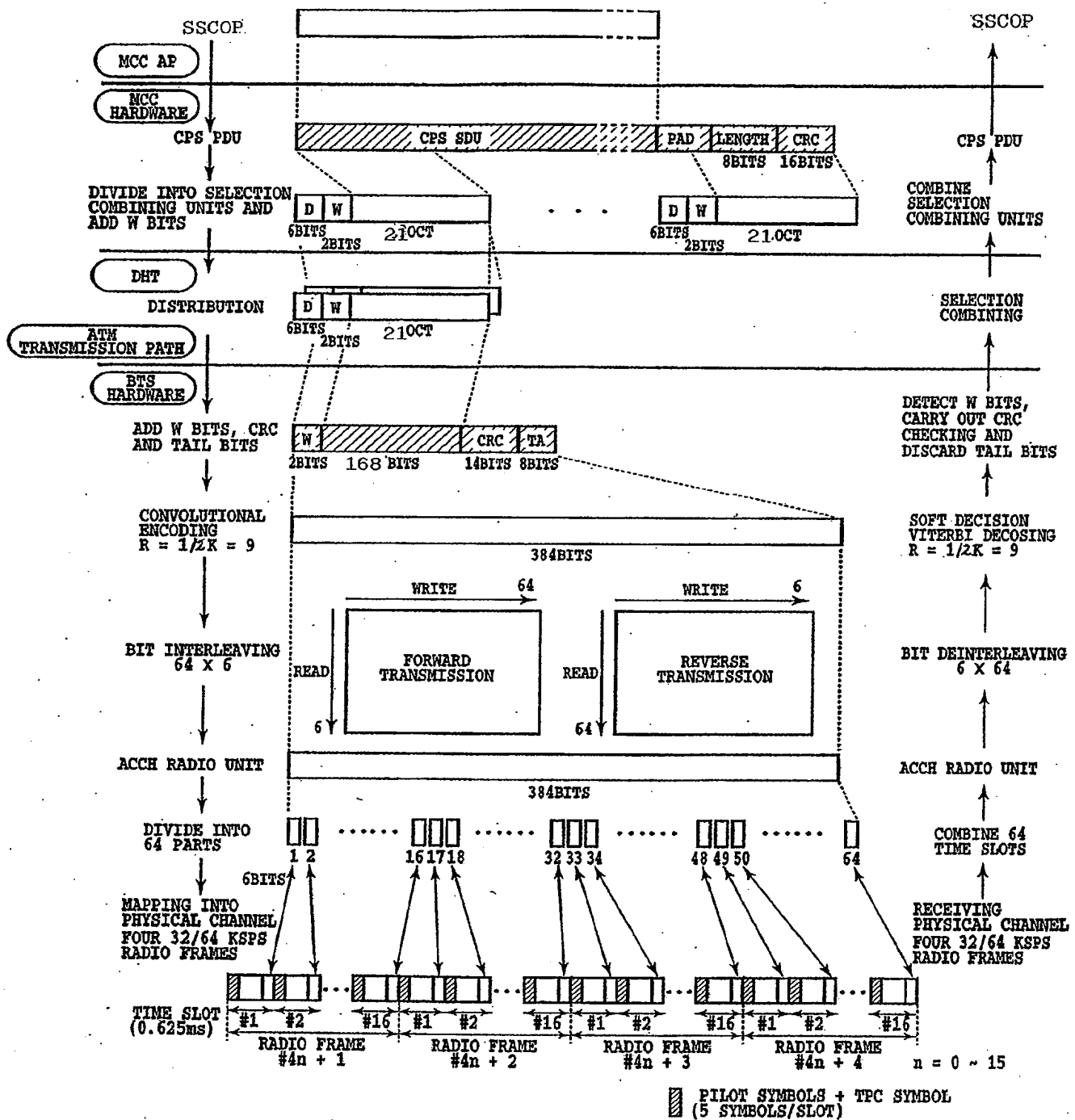
(Fig. 73)



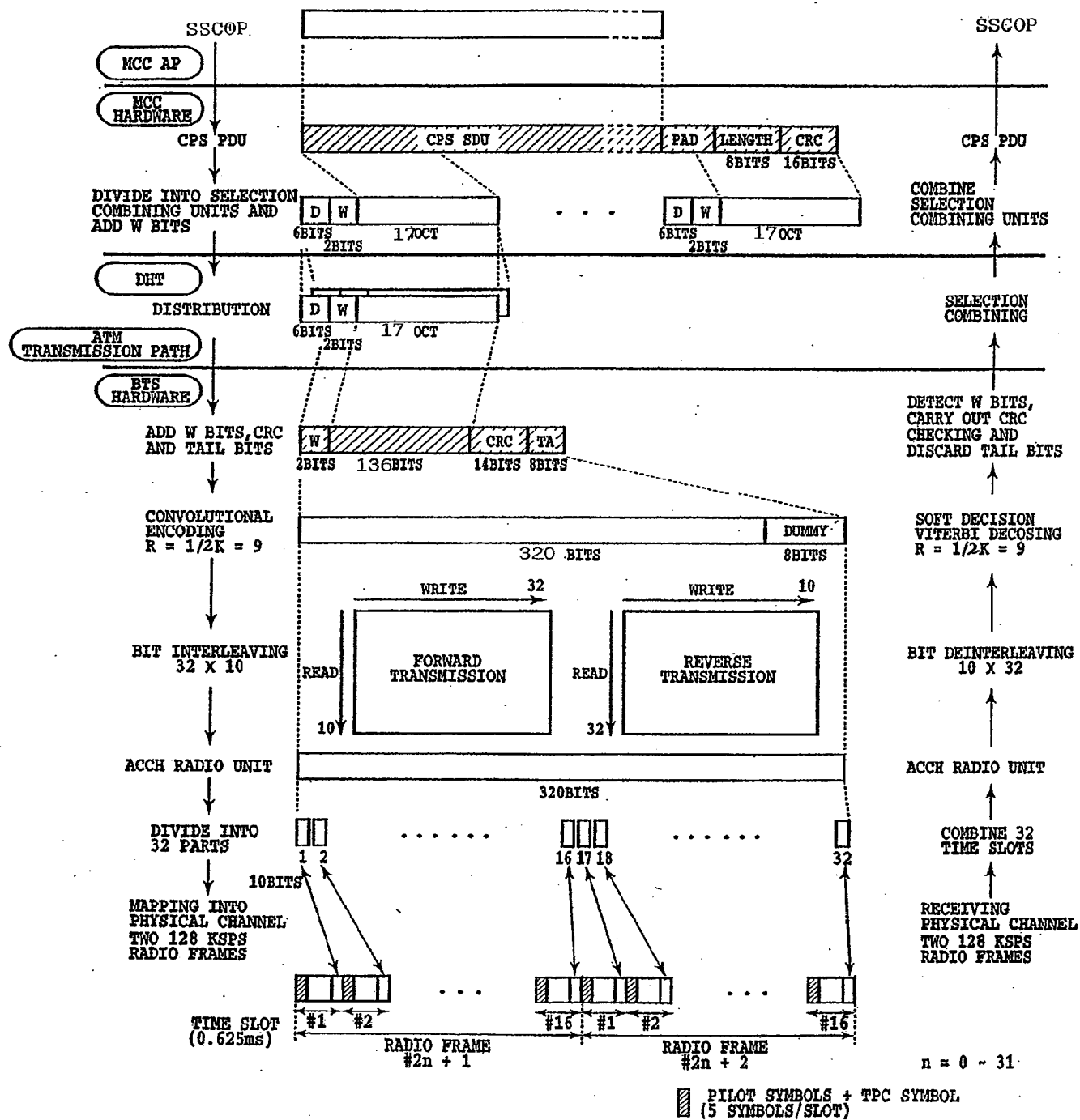
(Fig. 74)



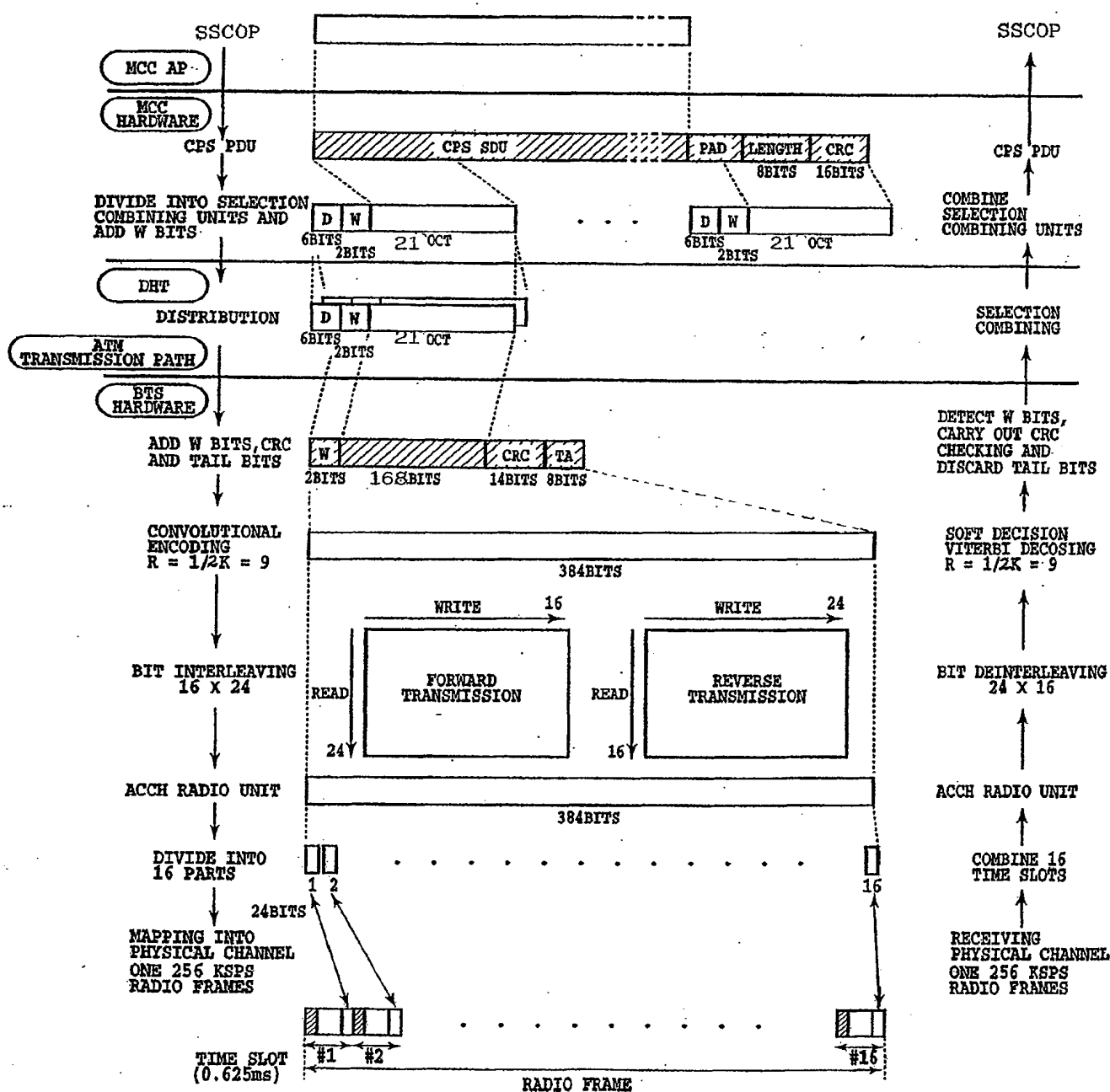
(Fig. 75)



(Fig. 76)

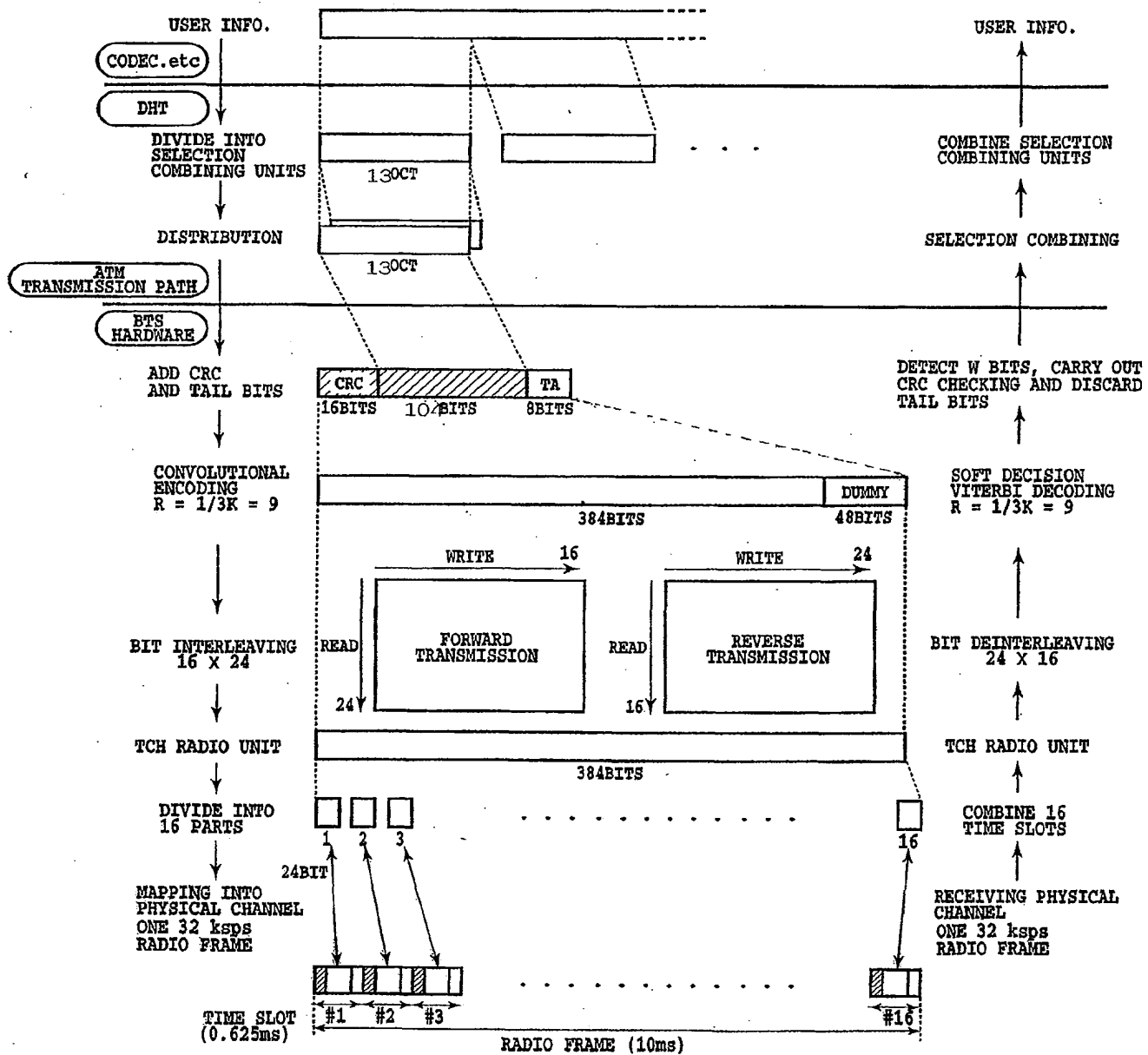


(Fig. 77)



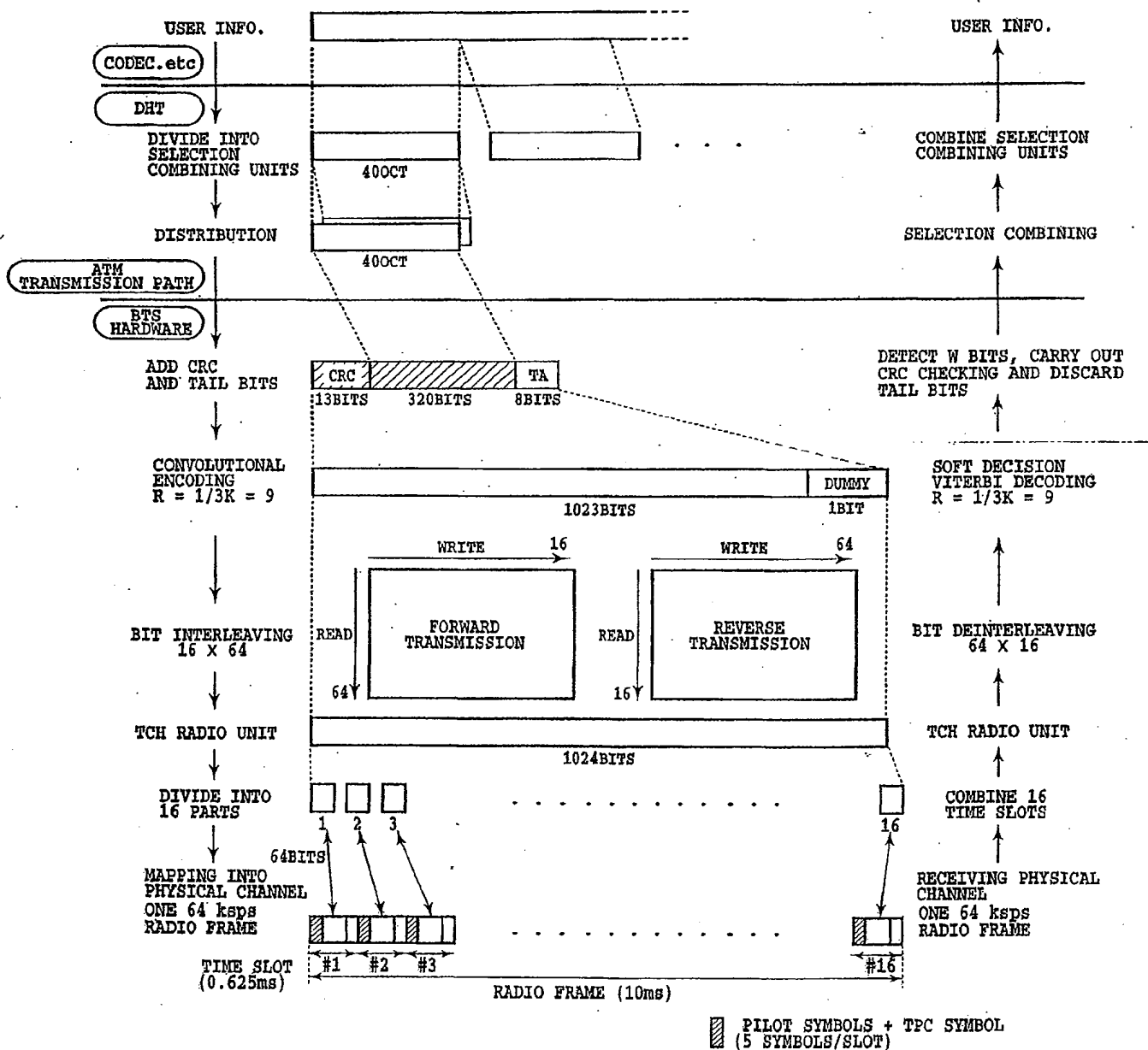
PILOT SYMBOLS + TPC SYMBOL
(9 SYMBOLS/SLOT)

(Fig. 78)

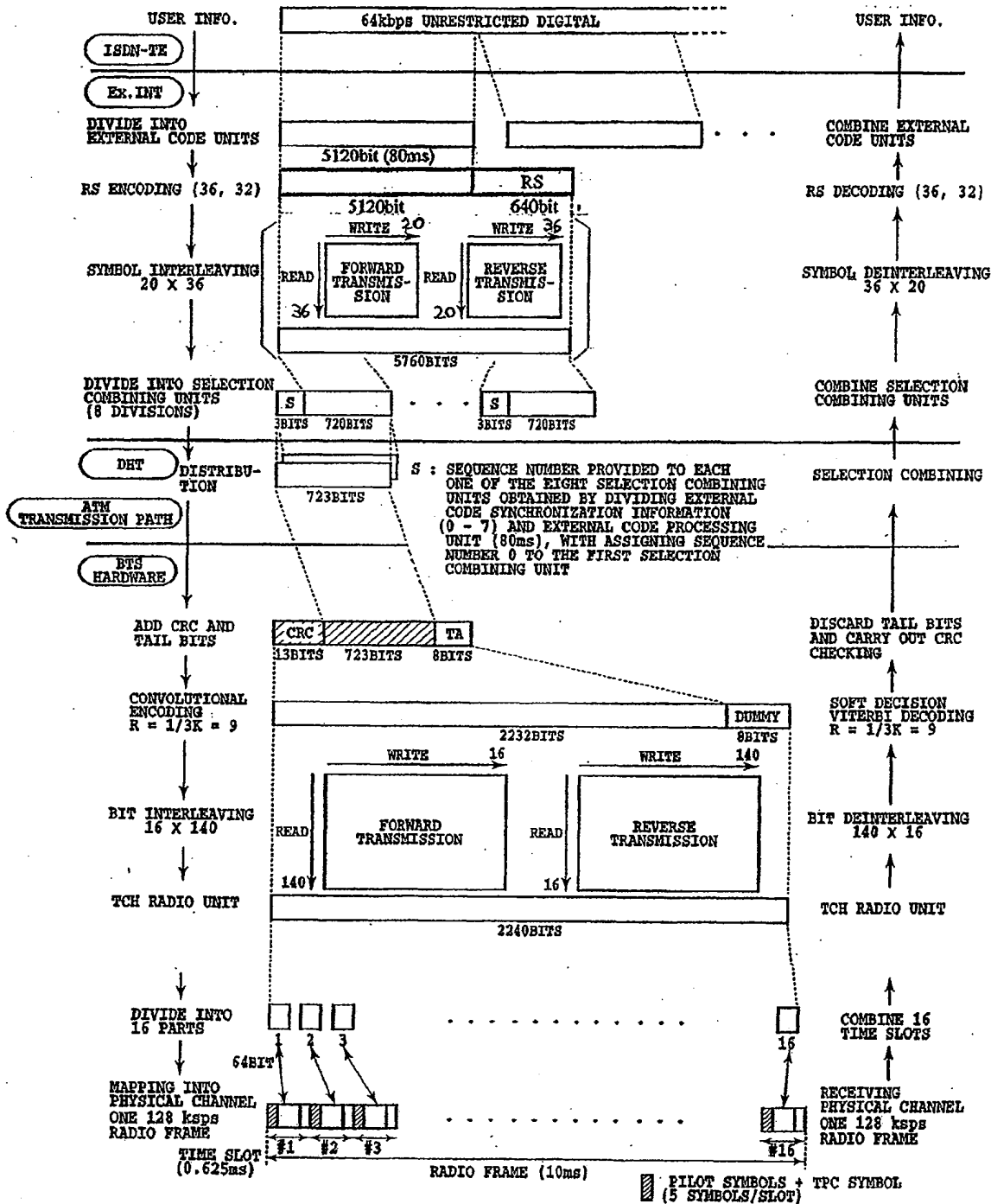


■ PILOT SYMBOLS + TPC SYMBOL
(5 SYMBOLS/SLOT)

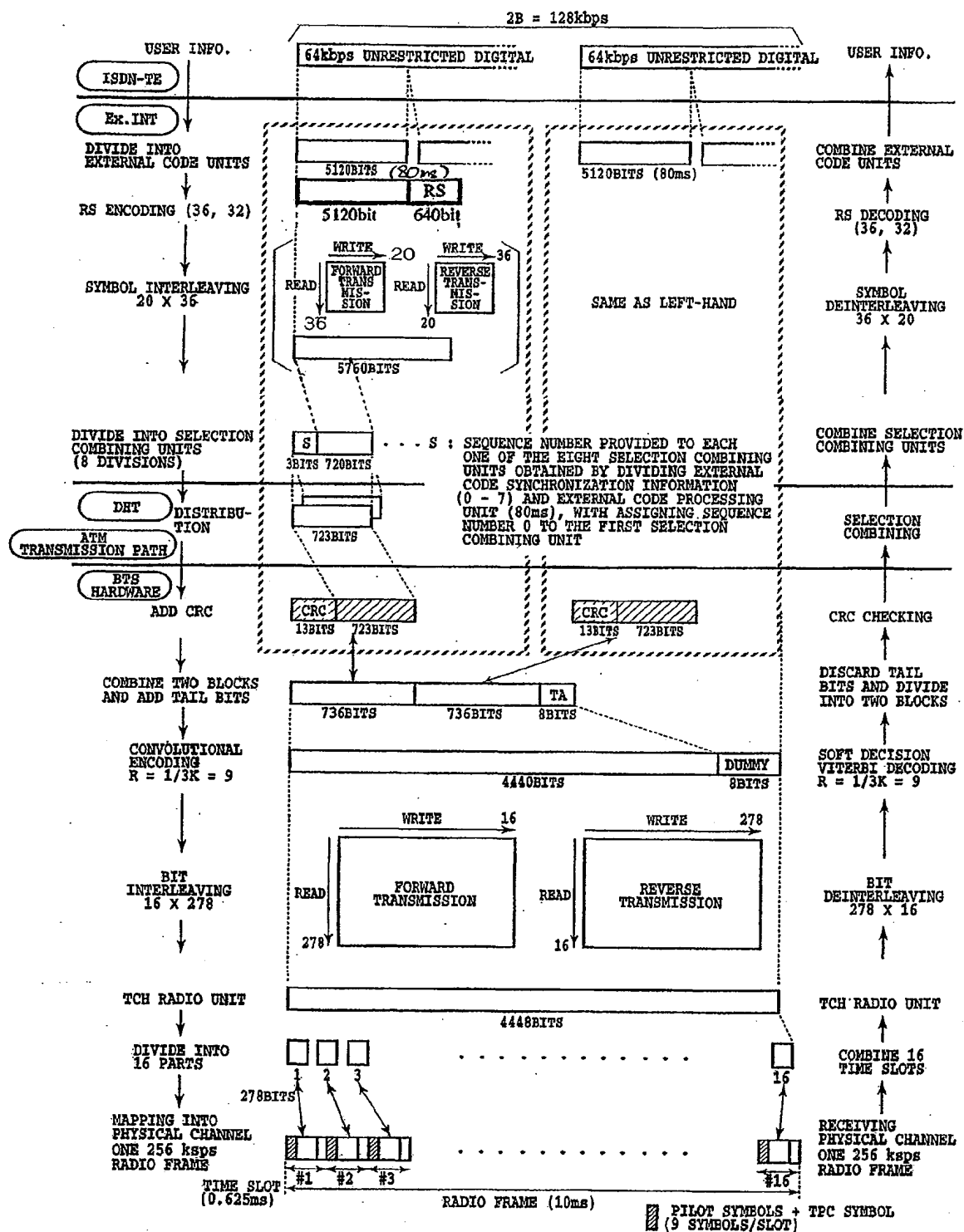
(Fig. 79)



(Fig. 80)



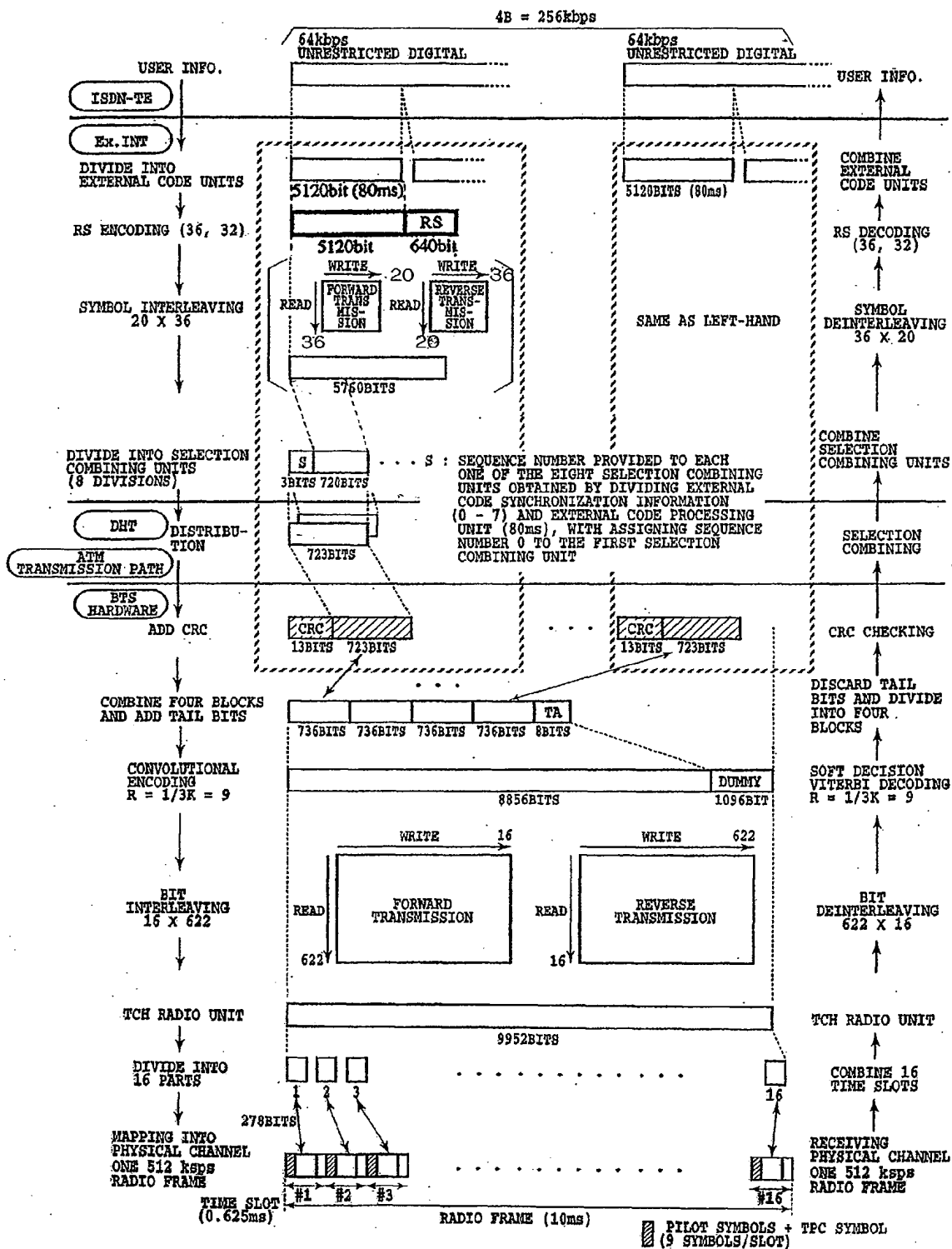
(Fig. 81)



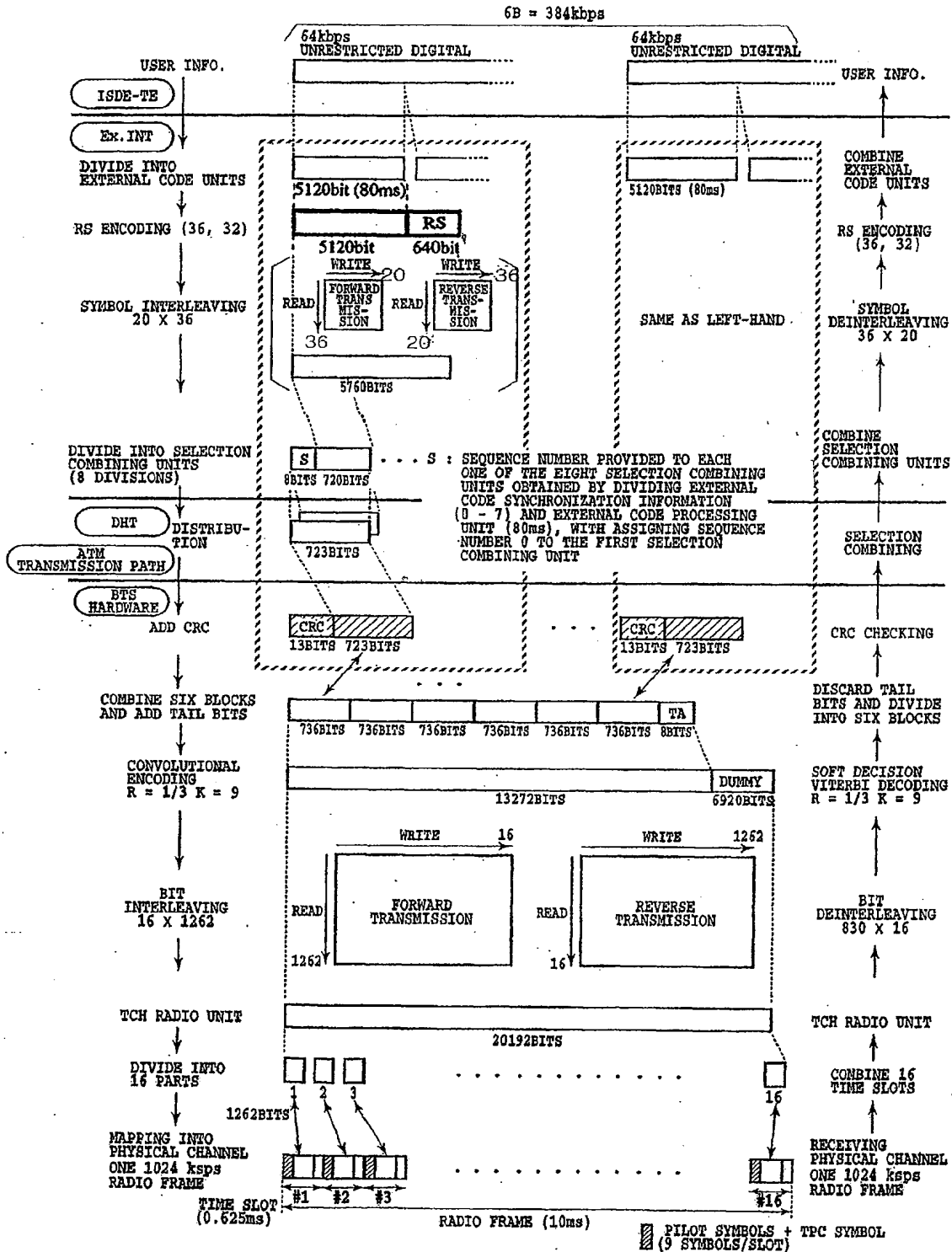
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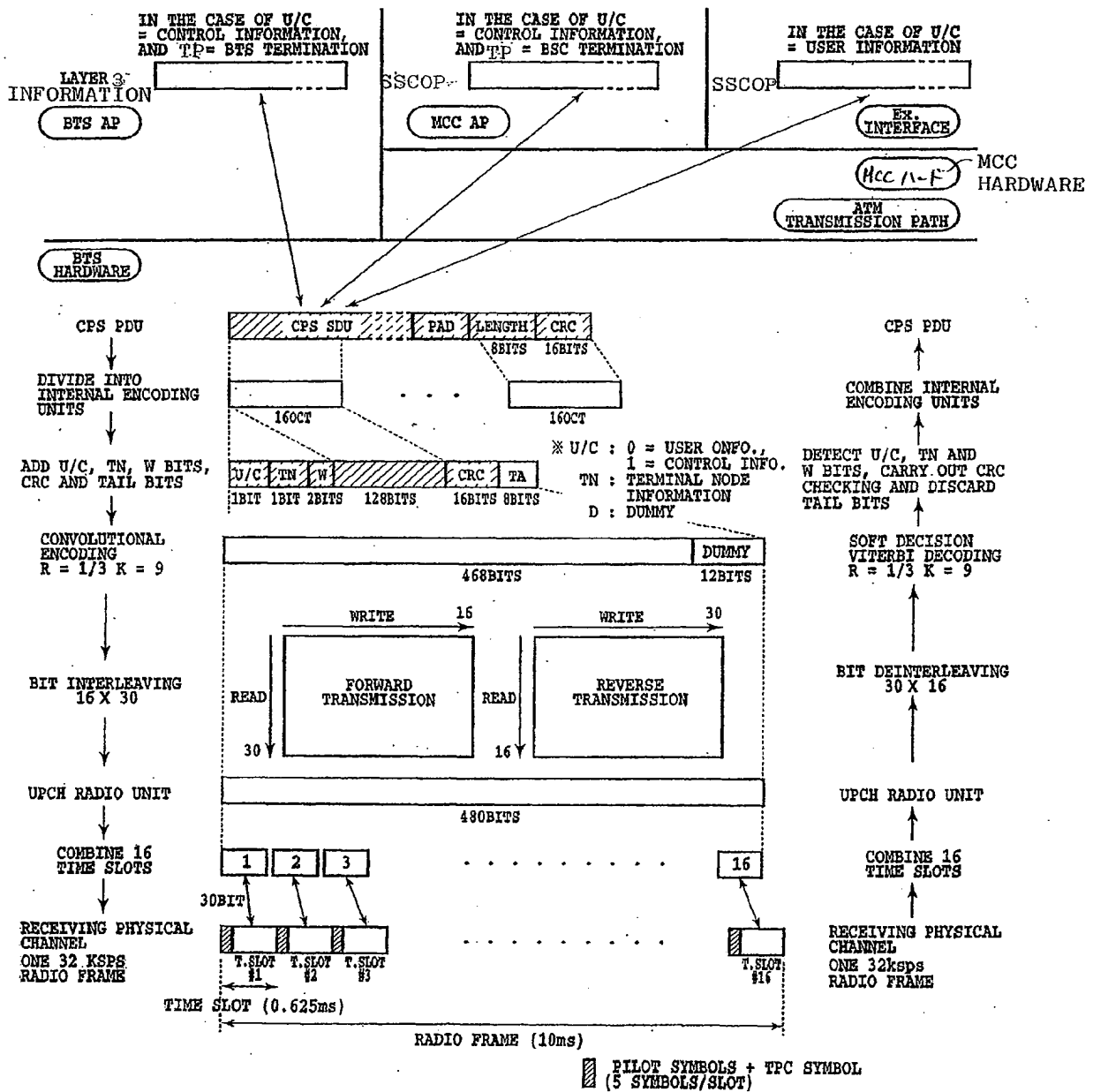
(Fig. 82)



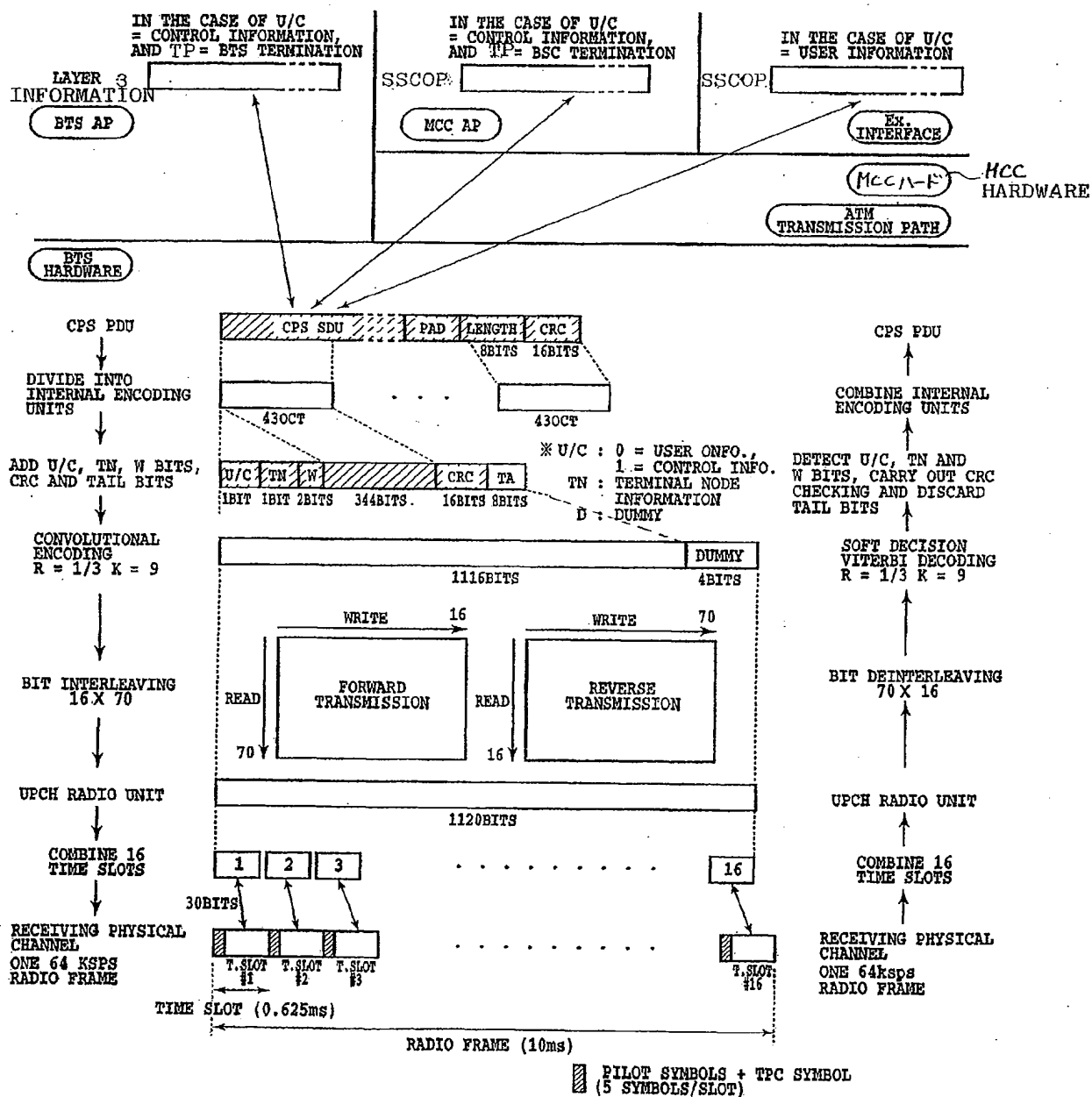
(Fig. 83)



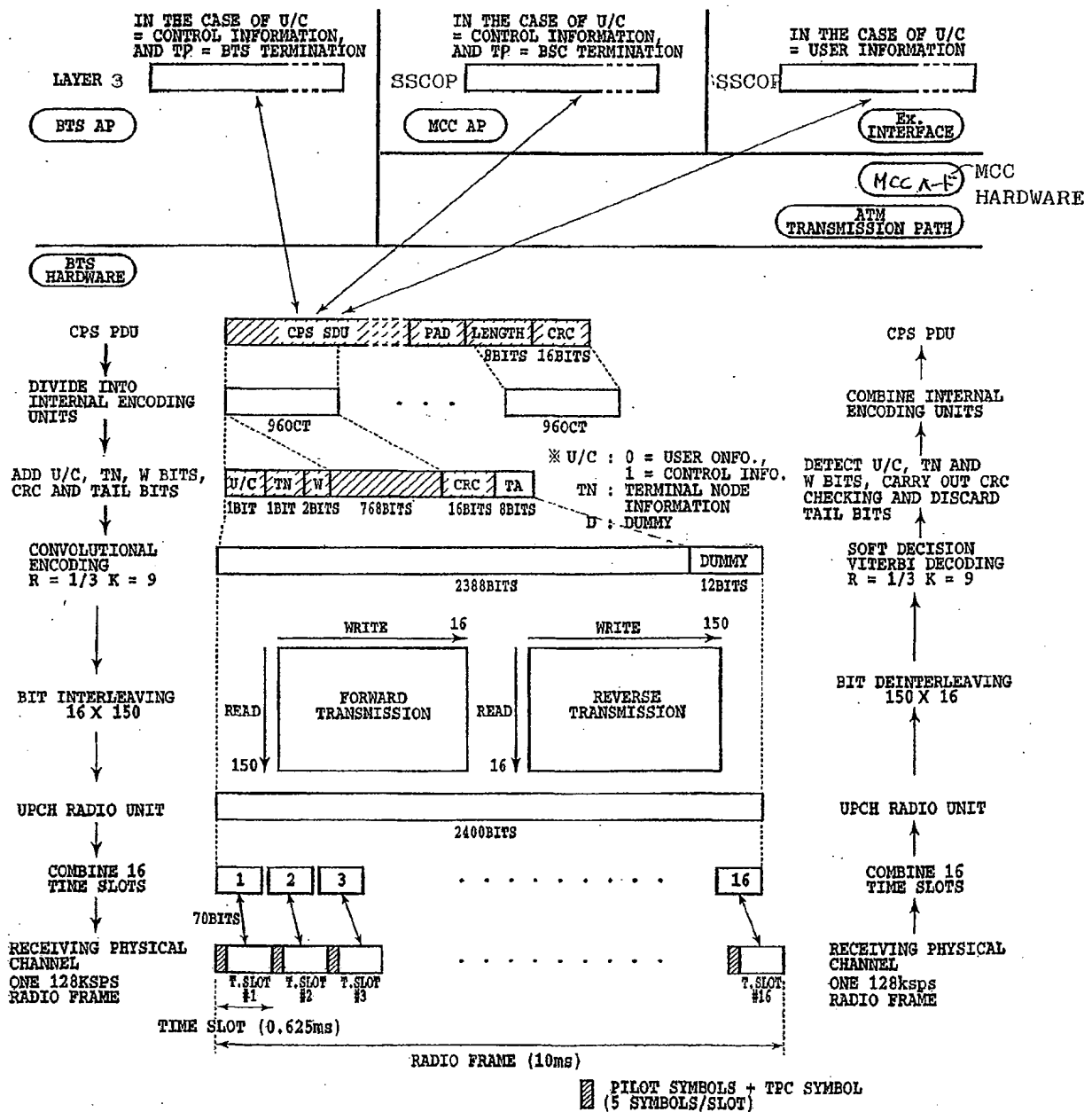
(Fig. 84)



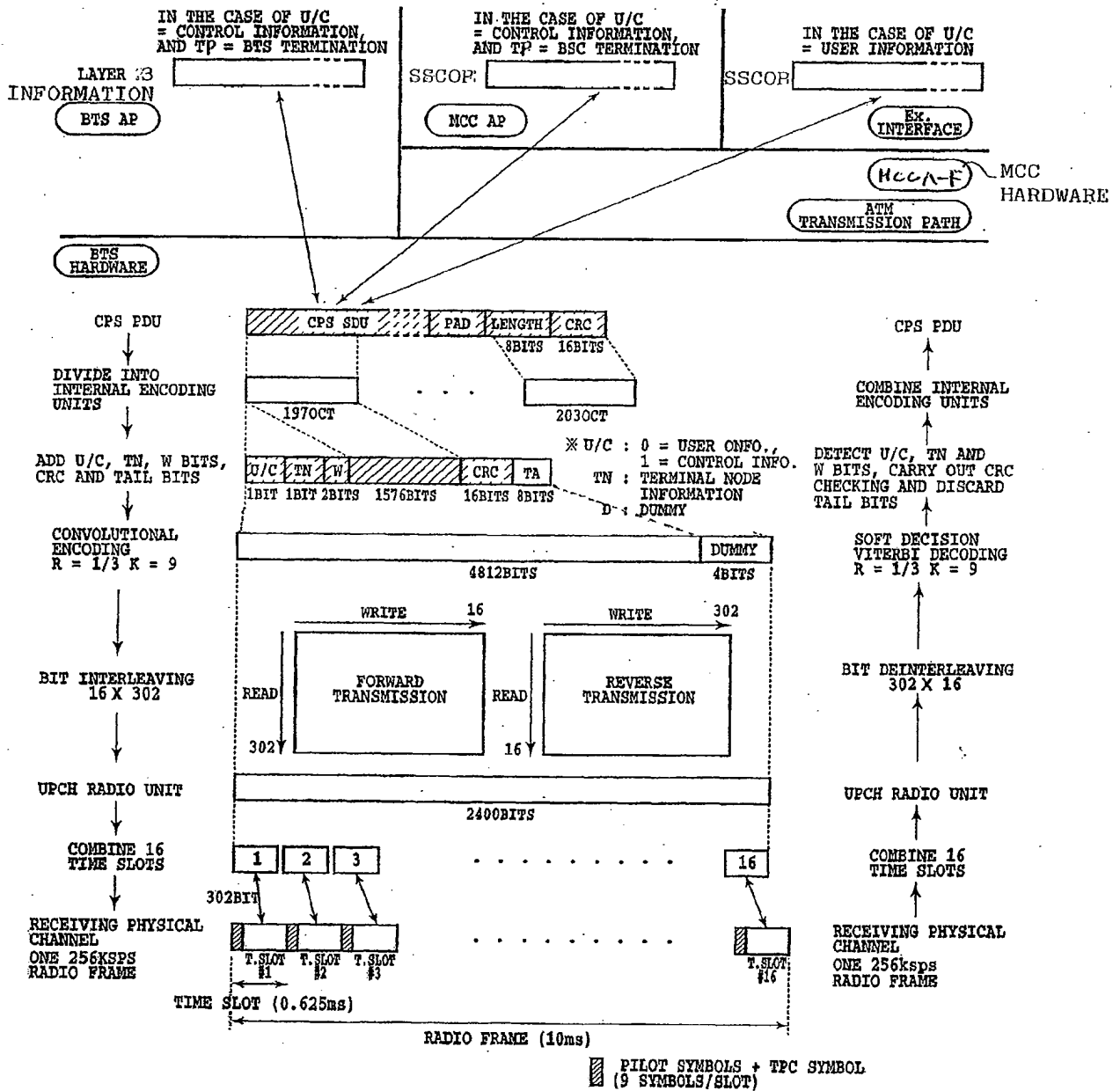
(Fig. 85)



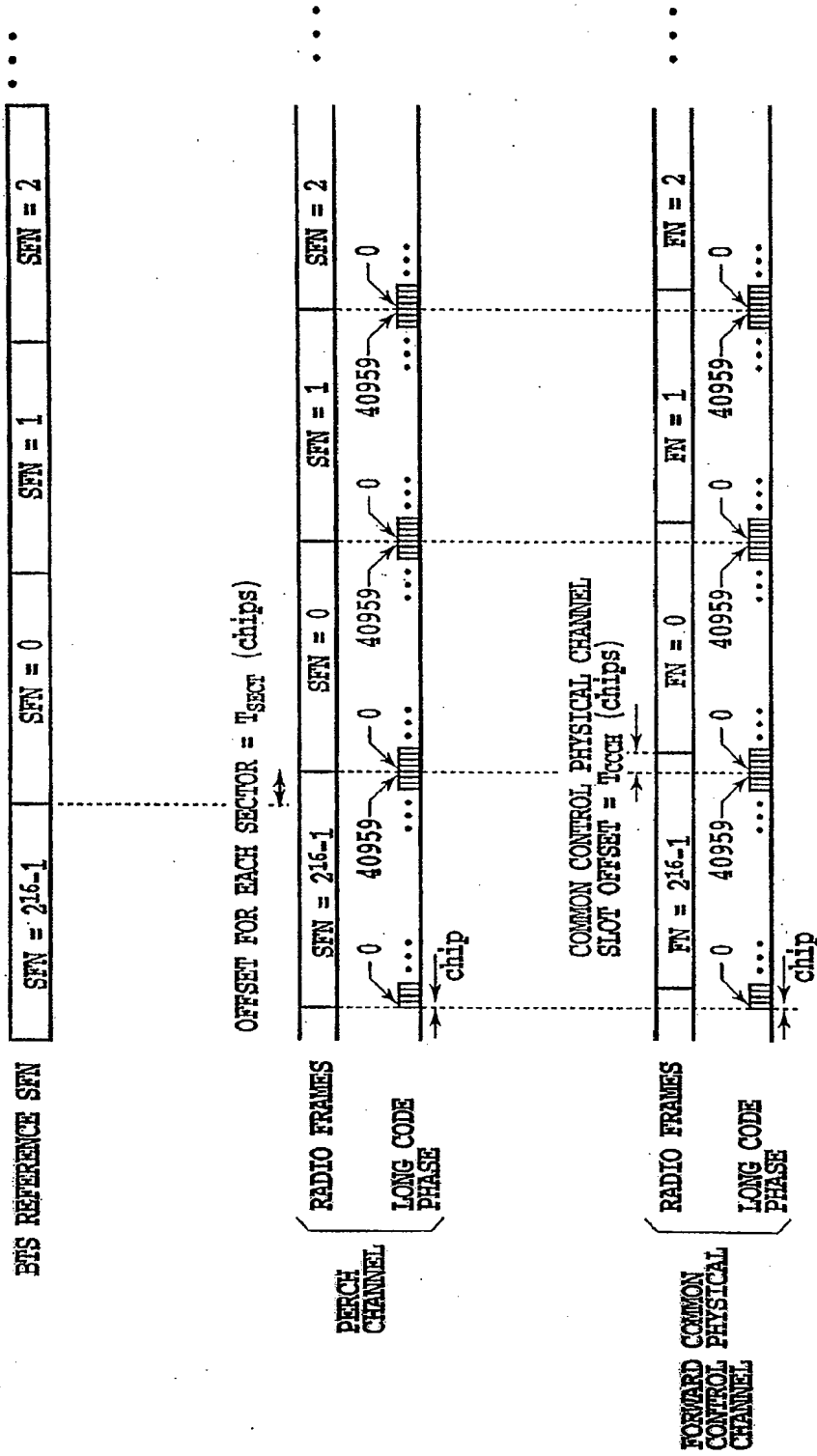
(Fig. 86)



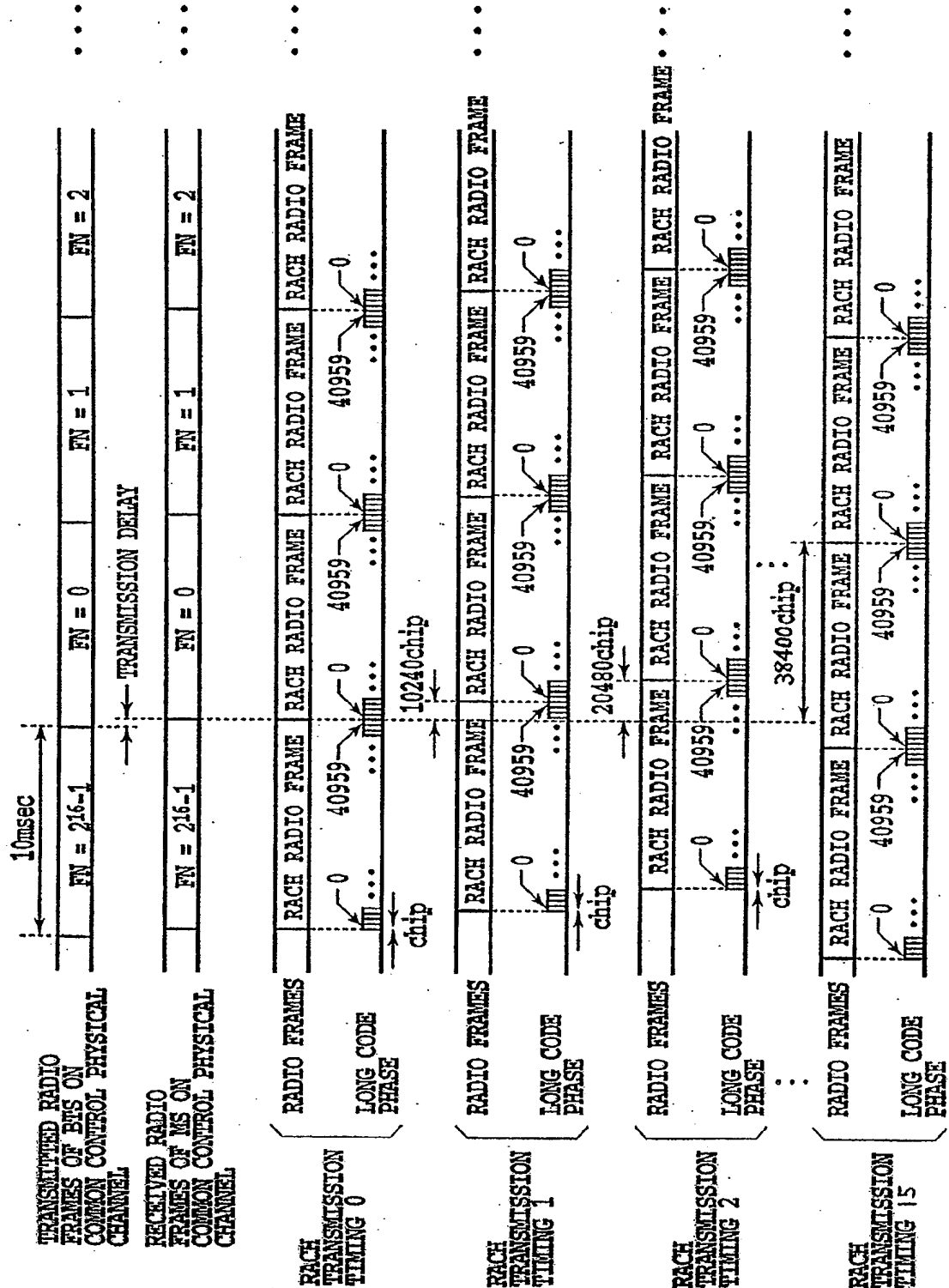
(Fig. 87)



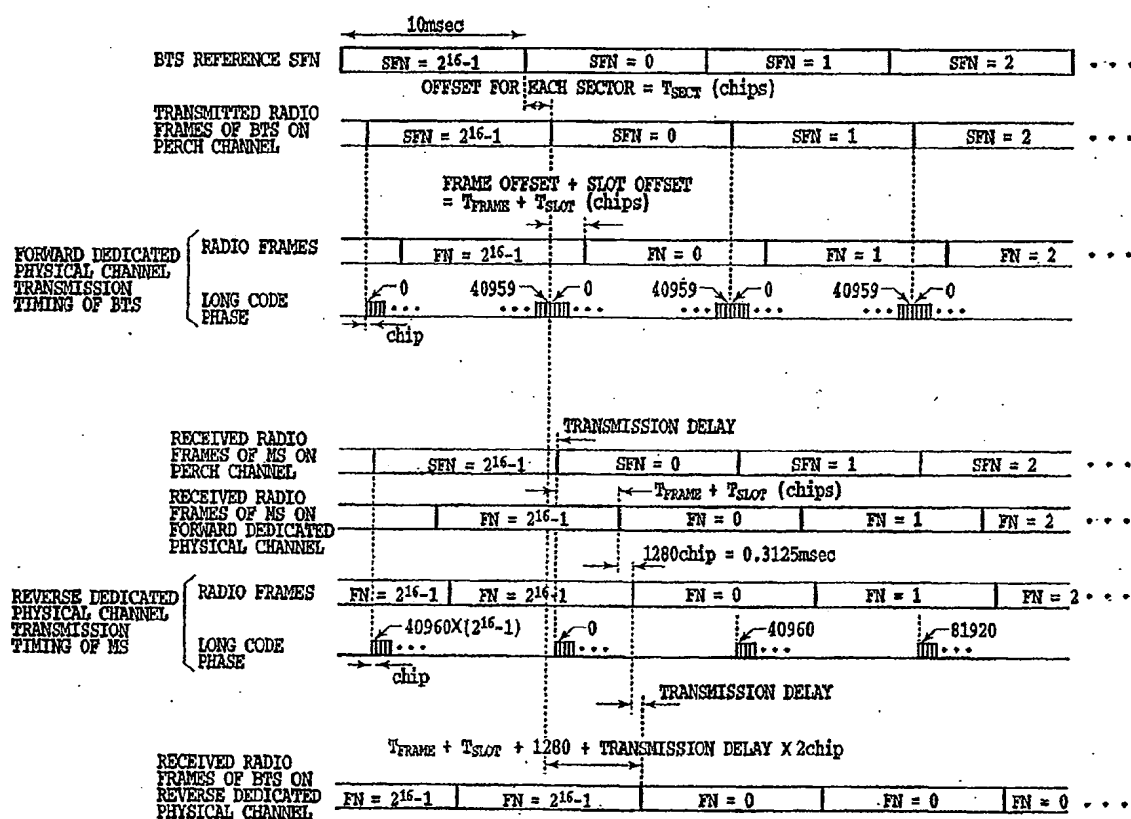
(Fig. 88)



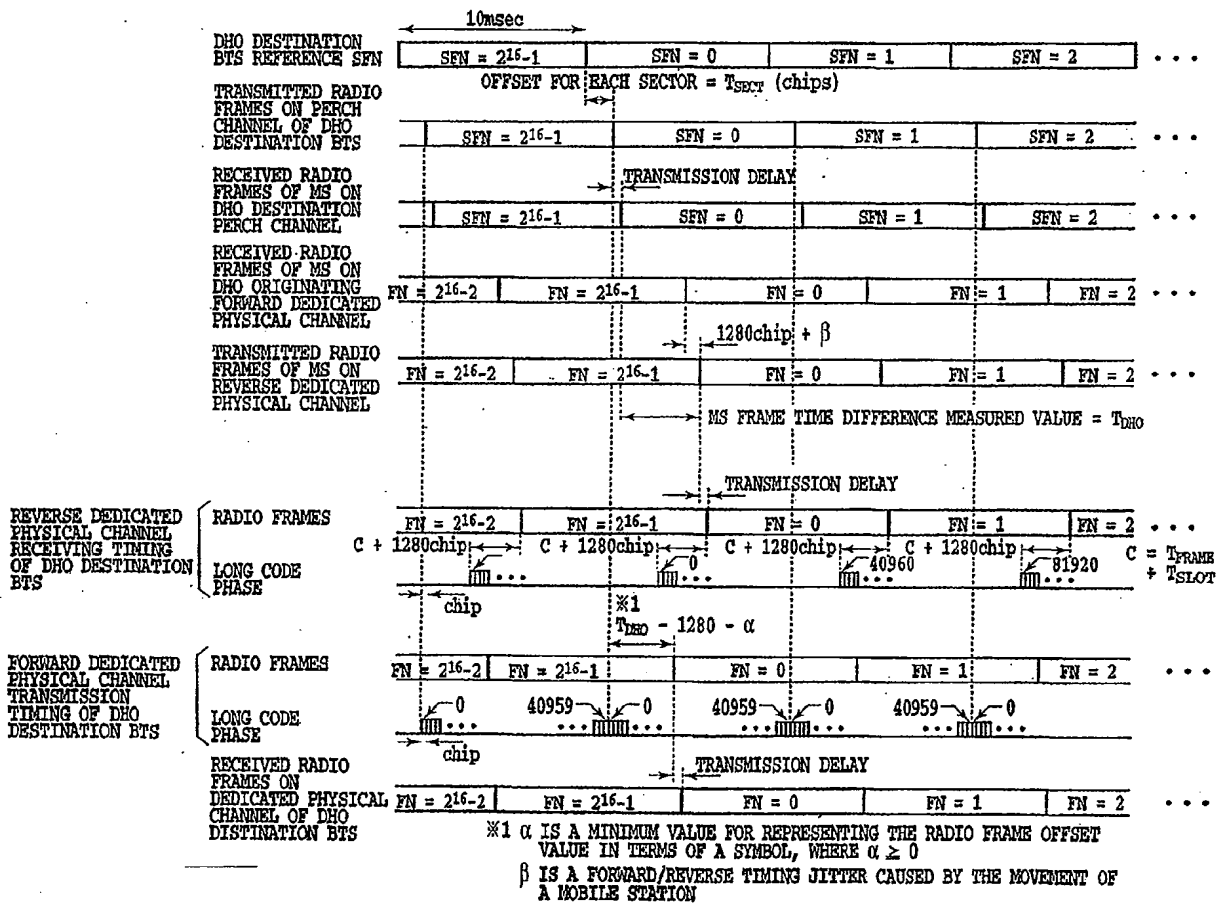
(Fig. 89)



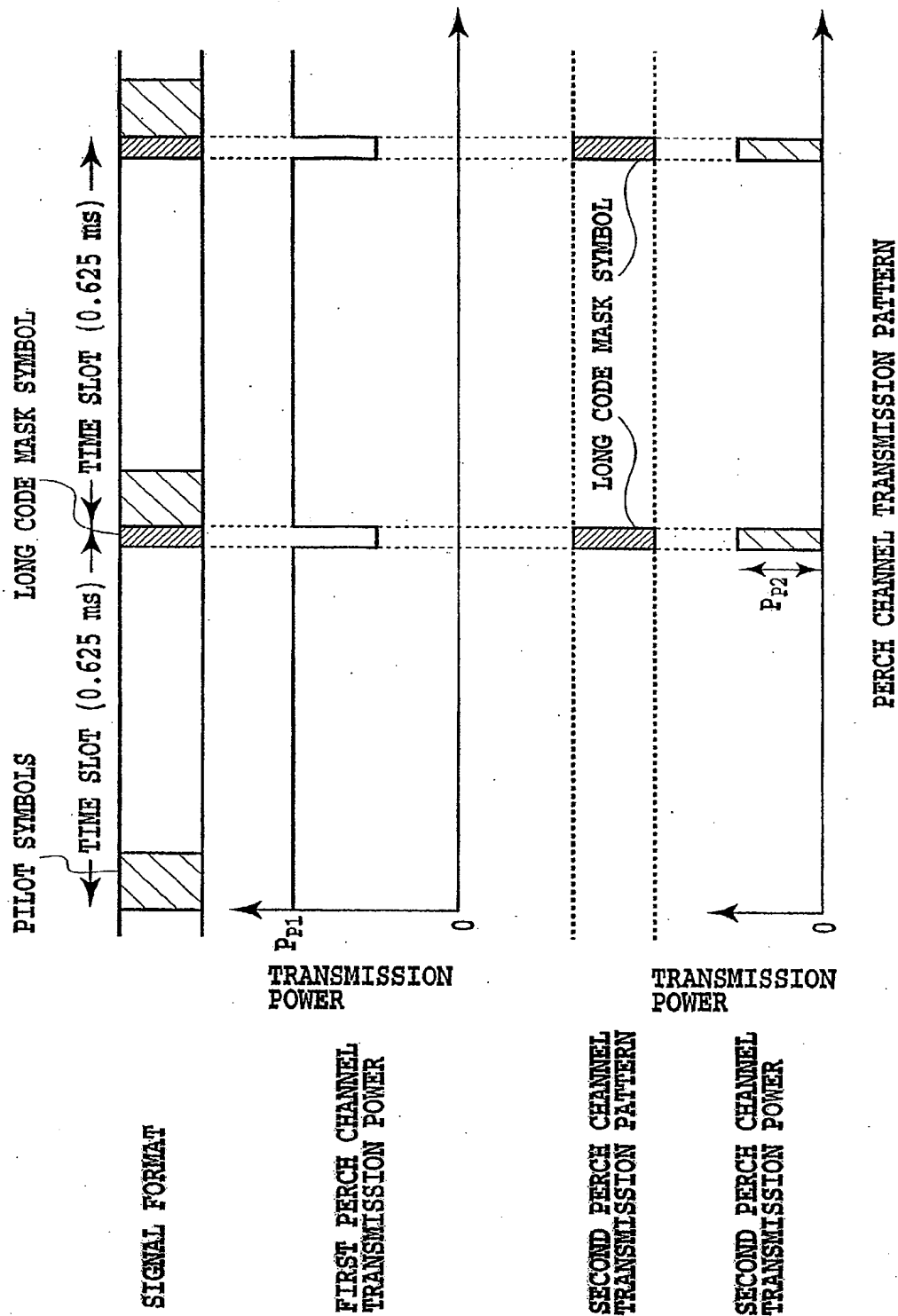
(Fig. 90)



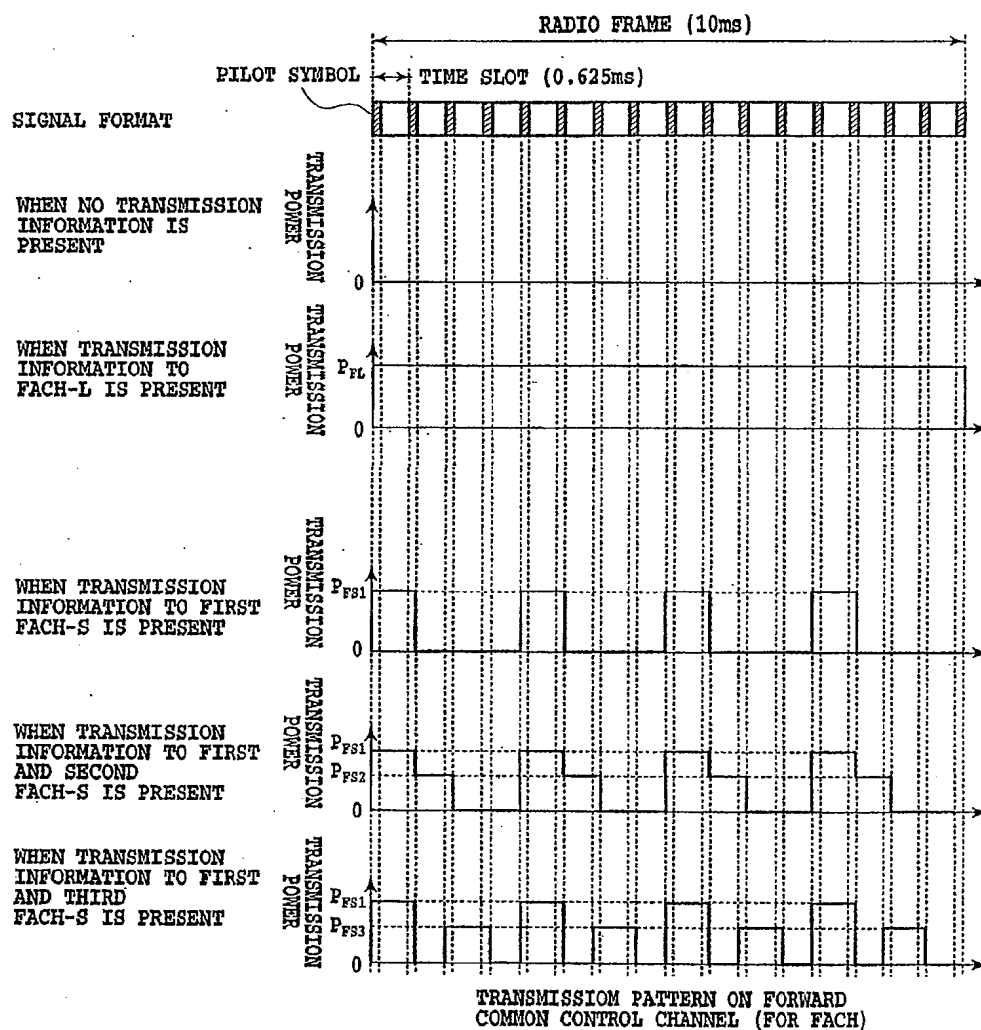
(Fig. 91)



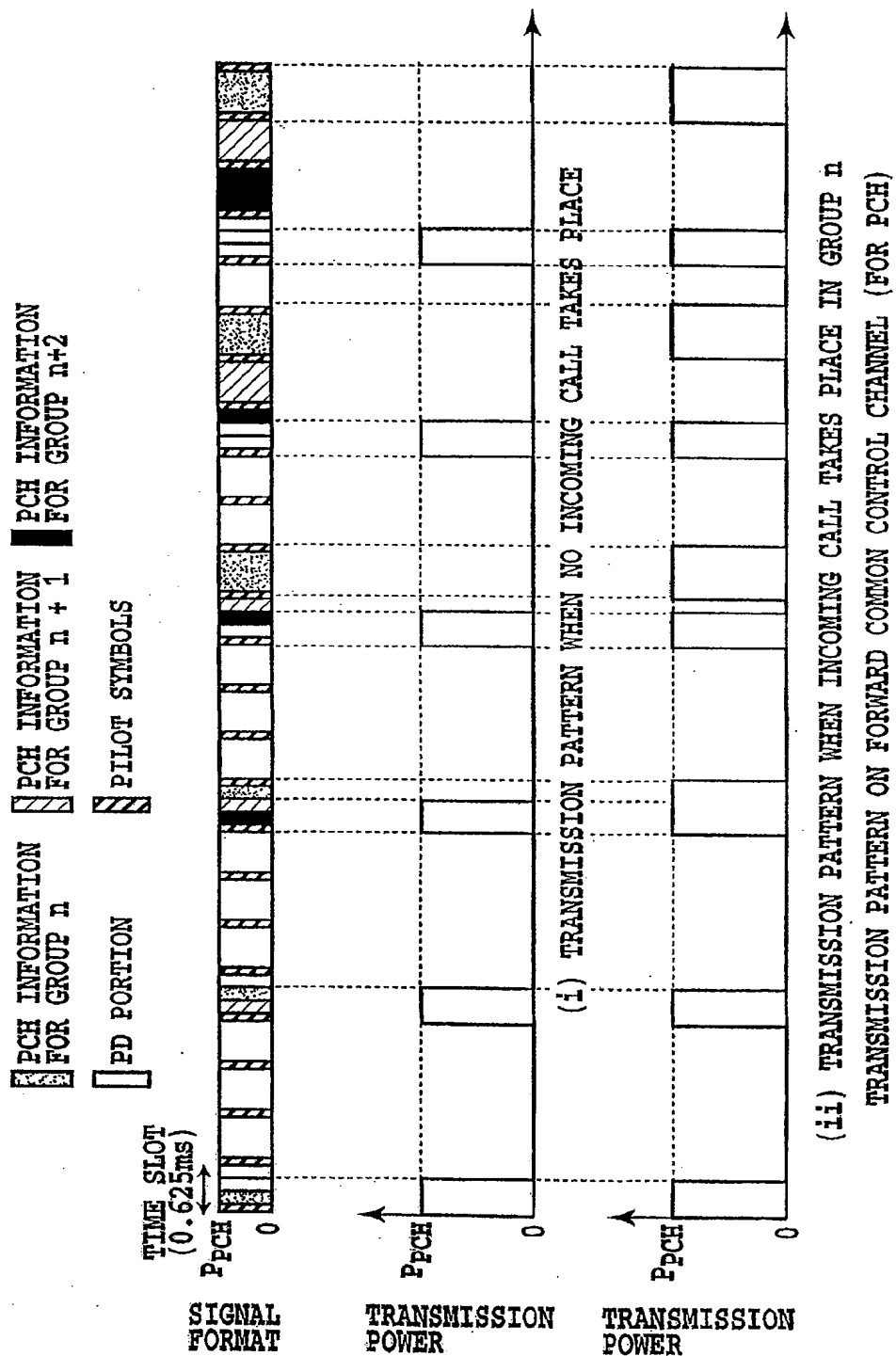
(Fig. 92)



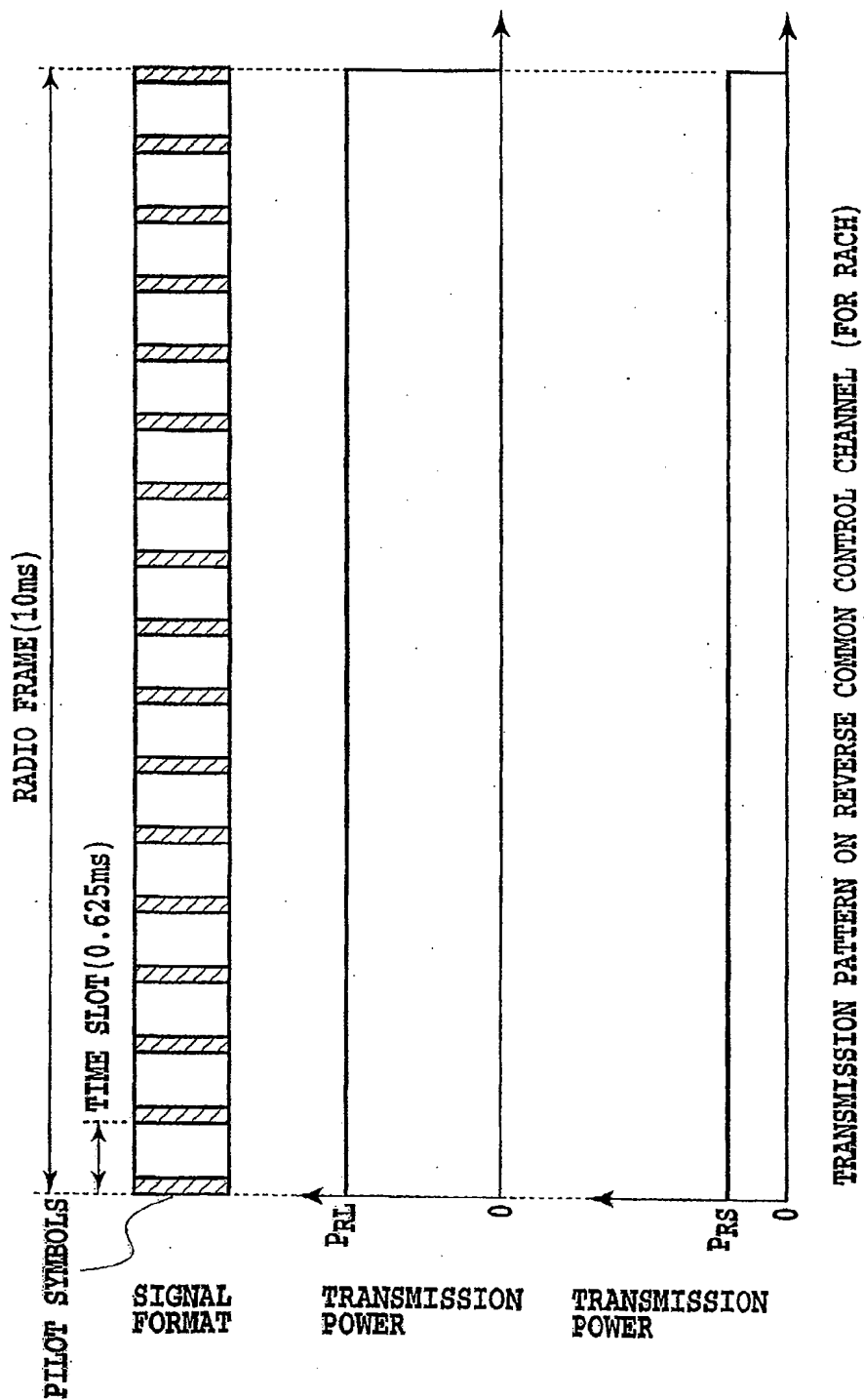
(Fig. 93)



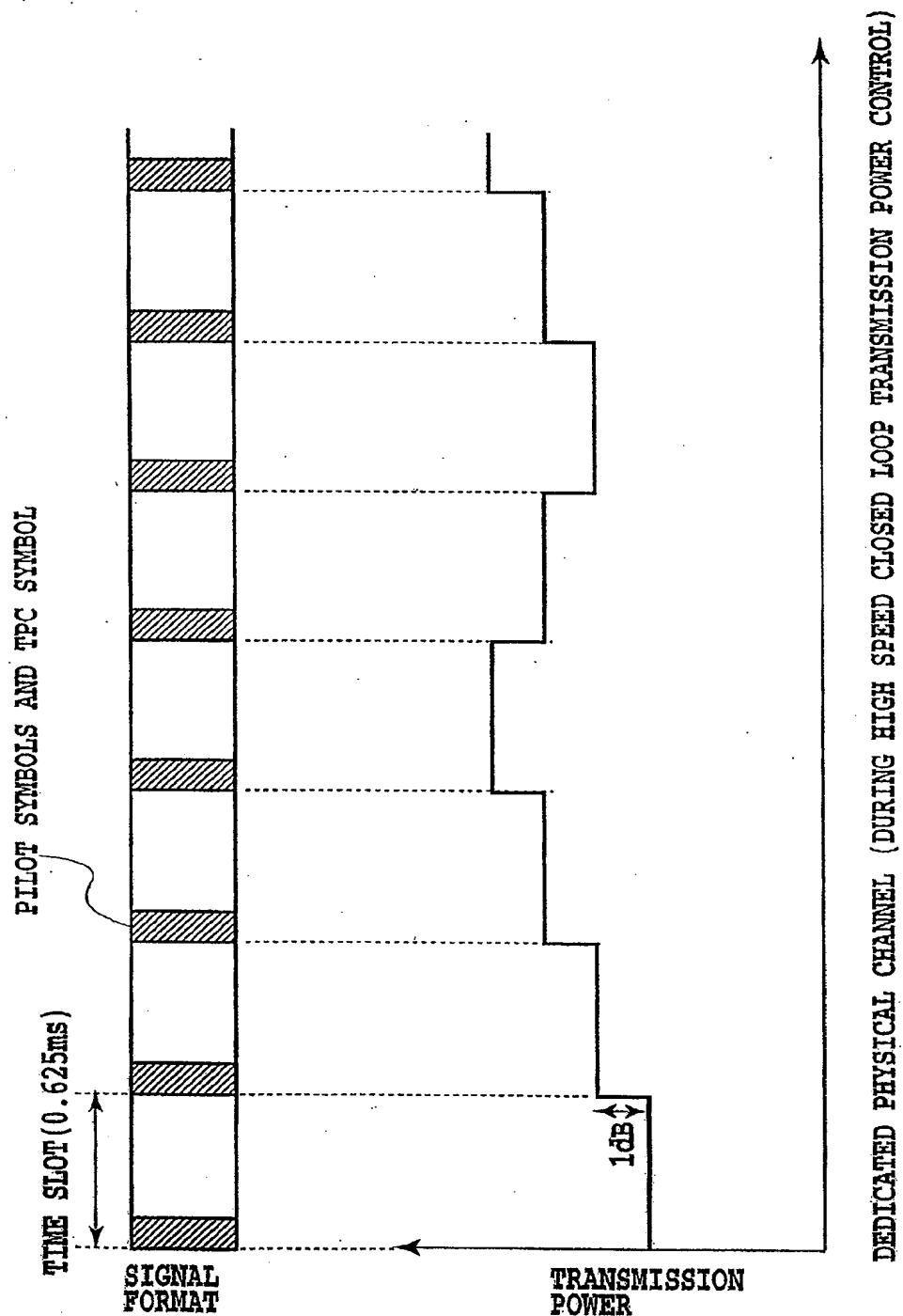
(Fig. 94)



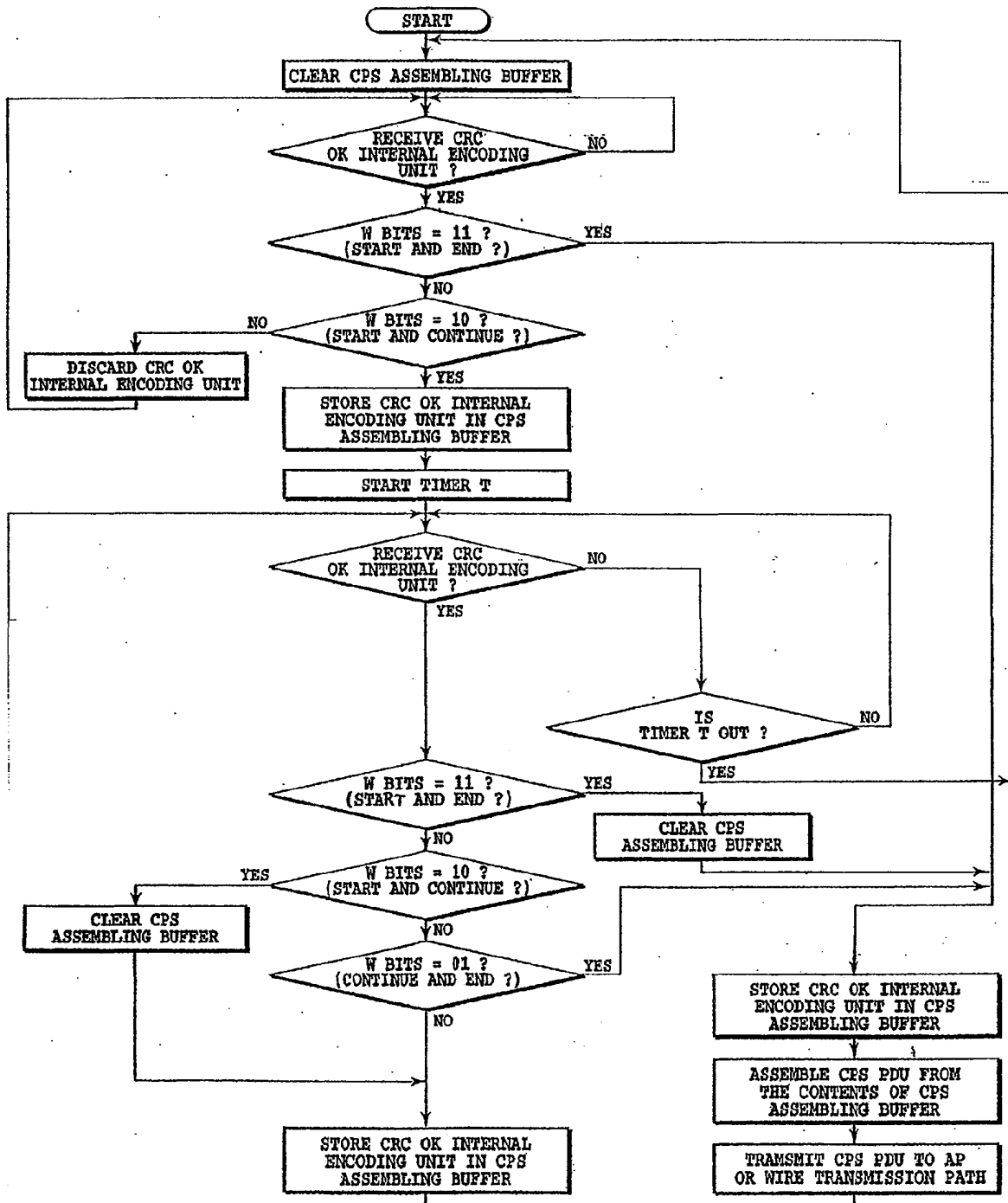
(Fig. 95)



(Fig. 96)



(Fig. 97)



(Fig. 98)

